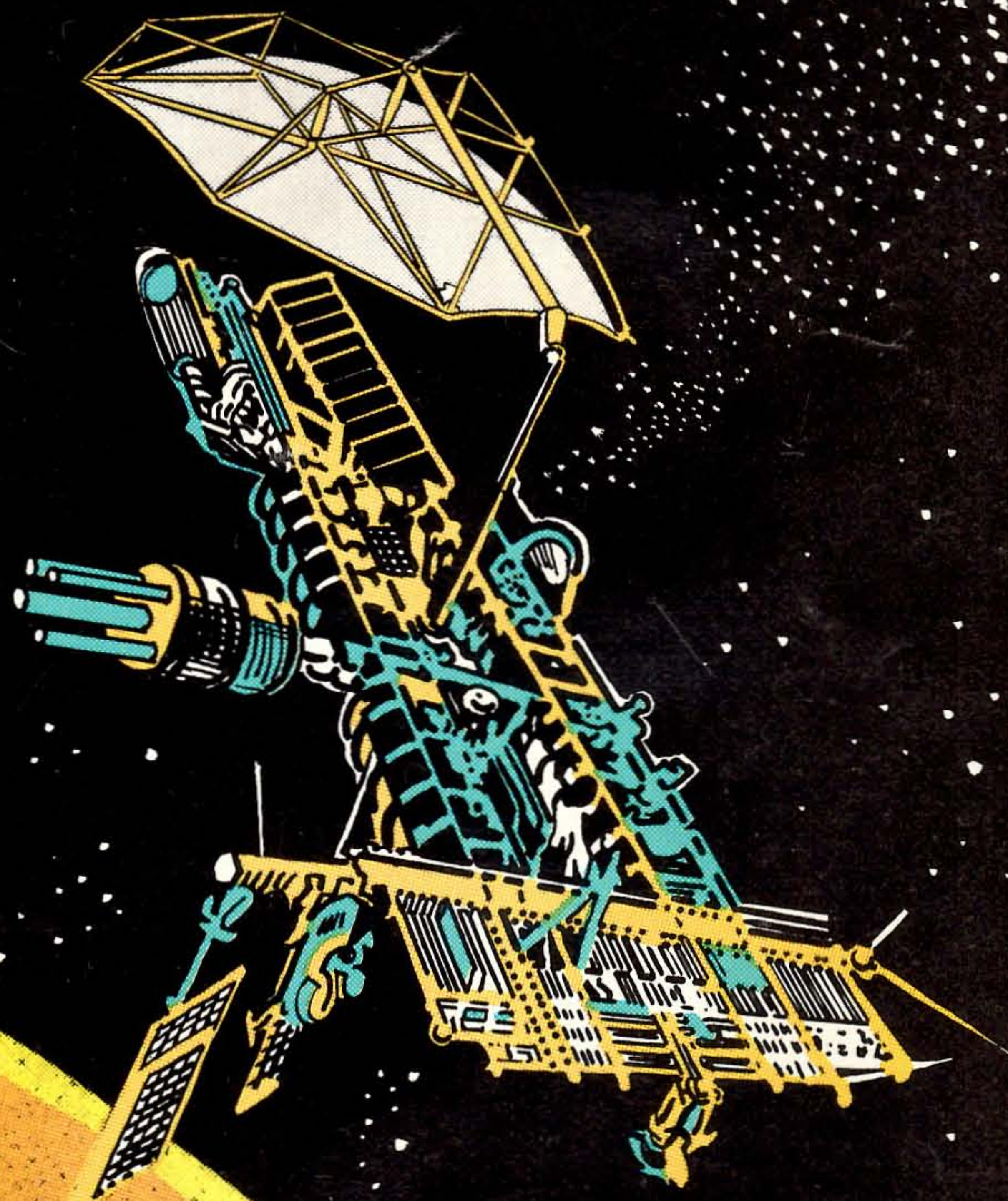


Radio Shack® presents the History of electronics

SPACE
EXPLORATION
...the next great
adventure!



FALL 1988

Radio Shack® presents the history of *Electronics*

GOOD MORNING,
MS. JONES!

GOOD MORNING, CLASS! I HOPE
THAT YOU HAD LOTS OF FUN DURING
YOUR SUMMER VACATION! THIS YEAR
WE ARE GOING TO STUDY MANY
EXCITING SCIENCE TOPICS...

LIKE DEVELOPMENT OF
THE TELEPHONE IN AMERICA... AND OTHER
FABULOUS INVENTIONS AND DISCOVERIES MADE
DURING THE "TELEPHONE AGE!"

WE'LL ALSO LEARN HOW
ELECTRICITY AND ELECTRONICS
AFFECT OUR DAILY LIVES... HOW THIS
ENERGY HELPED MAKE POSSIBLE TRAVEL
BY CARS, AIRPLANES, AND
SPACE SHUTTLES...

BUT WE KNOW THERE IS RISK
WITH MOST ANY SCIENTIFIC
ENDEAVOR AND THAT SAFETY IS
OF PRIME IMPORTANCE!

NOTHING WORTHWHILE IS
ACCOMPLISHED WITHOUT SOME
SACRIFICE... LONG HOURS OF
STUDY... DEADEND EXPERIMENTS
AND IN SOME CASES, EVEN
THE LOSS OF LIFE...

WRITER: BILL PALMER • ARTIST: JIM WEATHERS

CAT. NO. 68-2036

Fall 1988, Spring 1989 edition of the HISTORY of ELECTRONICS. Bill Palmer, Editor. Published by the Radio Shack Division of Tandy Corporation, One Tandy Center, Fort Worth, Texas 76102 U.S.A. Copyright © 1987 by Tandy Corporation, One Tandy Center, Fort Worth, Texas 76102 U.S.A. All rights reserved. Science Fair, TRS-80, Radio Shack, Tandy 1000, Realistic and Pocketvision are trademarks of Tandy Corporation, Radio Shack Division. CompuServe is a trademark of CompuServe, Inc.

Narrative by Bill Palmer. Graphics by Weathers Graphic Design. Neither Radio Shack nor Tandy Corporation, nor any of their employees makes any warranty, expressed or implied for the accuracy, completeness or usefulness of the information contained in this publication which is distributed free to students, teachers, schools and other people interested in science topics. Nothing may be reprinted in whole or part without written permission from the publisher. Printed in the United States of America. First printing September 1987. Second printing September 1988.

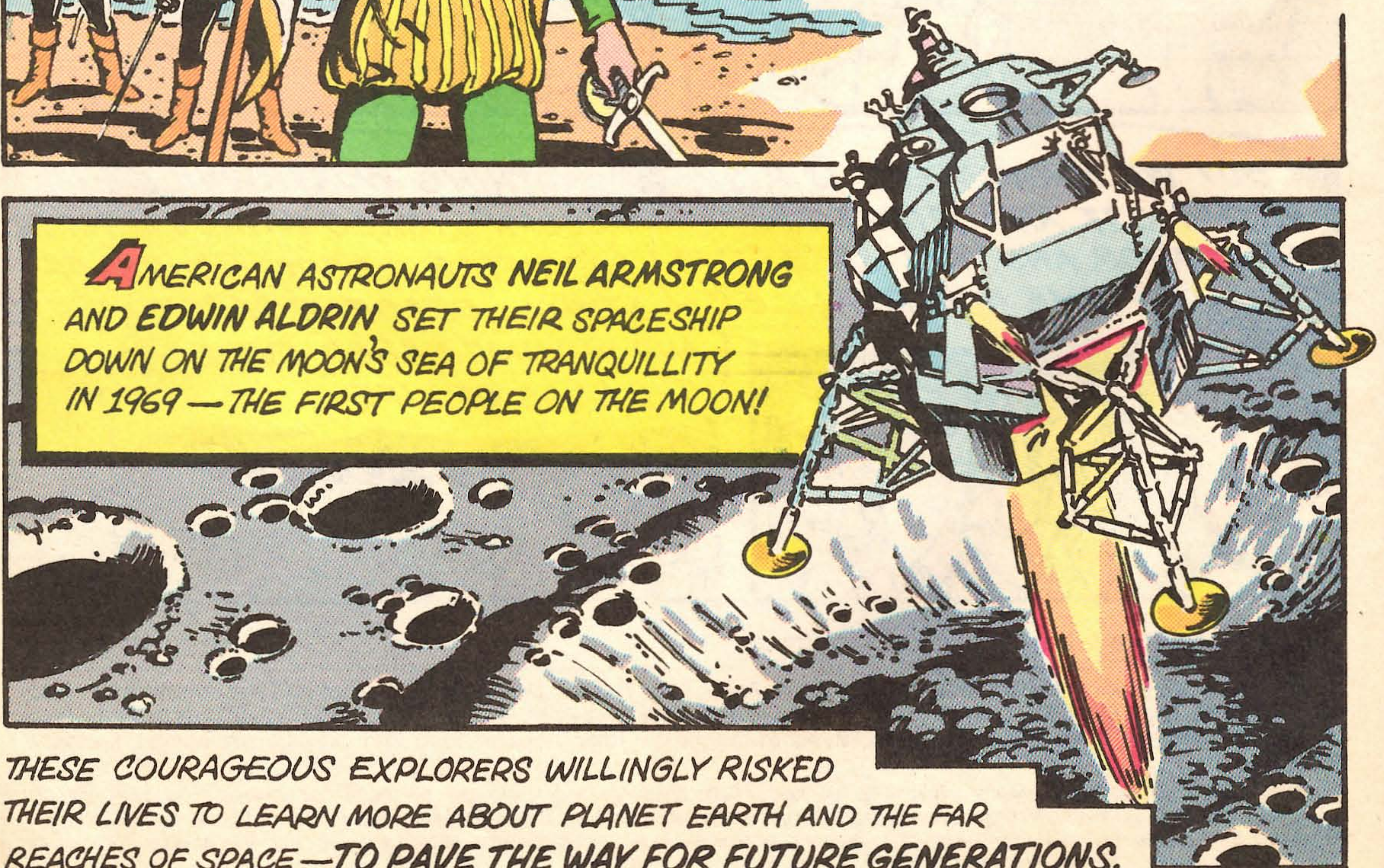
BUT WE CAN'T LET THAT STOP OUR QUEST FOR KNOWLEDGE AND MORE ADVANCEMENTS... AS HARSH AS IT MAY BE... BUT WHAT WE MUST DO IS IMPROVE DESIGNS AND OBSERVE ALL SAFETY RULES... LIKE ALWAYS "BUCKLE UP" WHEN RIDING IN A CAR!

MANY CENTURIES AGO THE HARDY VIKINGS, IN LARGE BOATS WITH SAILS RISKED THEIR LIVES ACROSS PERILOUS STRETCHES OF THE NORTH ATLANTIC OCEAN — SEARCHING FOR NEW LANDS — LEARNING HOW TO NAVIGATE THEIR SHIPS ON LONG VOYAGES.

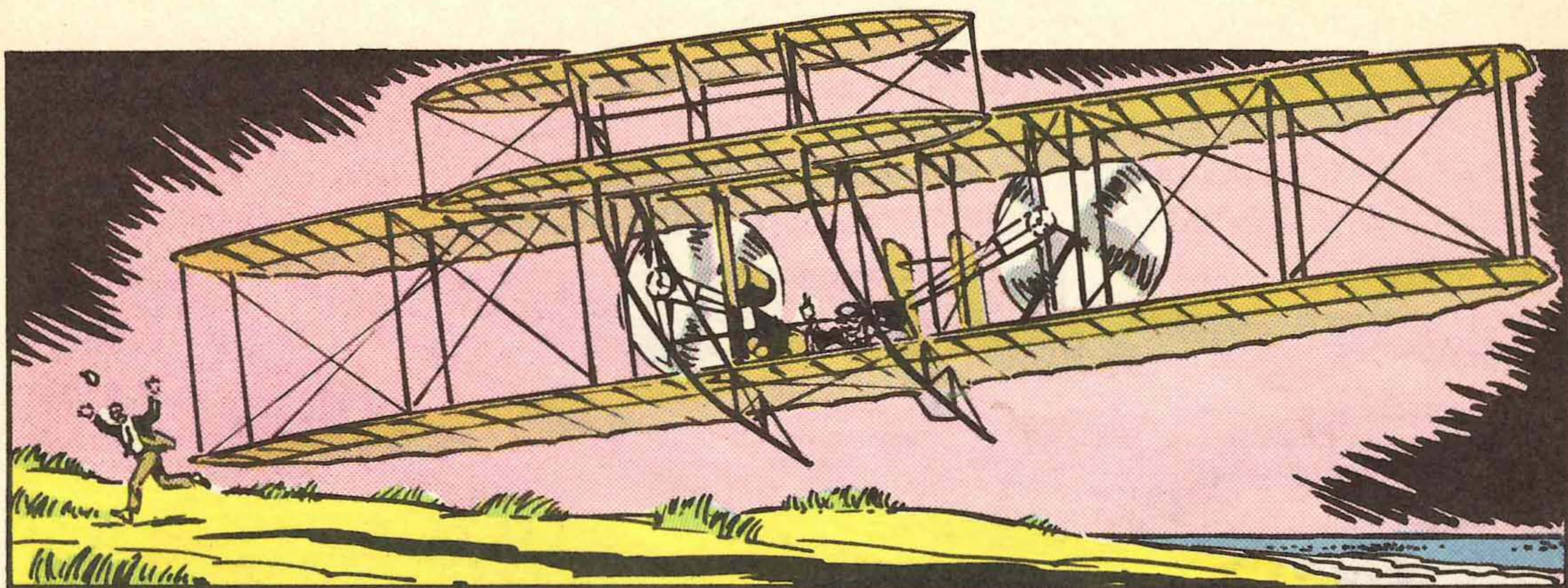


CHRISTOPHER COLUMBUS AND HIS DARING SAILORS IN THREE TINY SHIPS, THE PINTA, NIÑA AND THE SANTA MARIA CROSSED THE UNCHARTED ATLANTIC OCEAN IN 1492 — LOOKING FOR A NEW TRADE ROUTE. INSTEAD, THEY DISCOVERED THE WEST INDIES ISLANDS NEAR THE FUTURE UNITED STATES OF AMERICA, BUT NOT ALL WENT WELL THE SANTA MARIA WAS LOST.

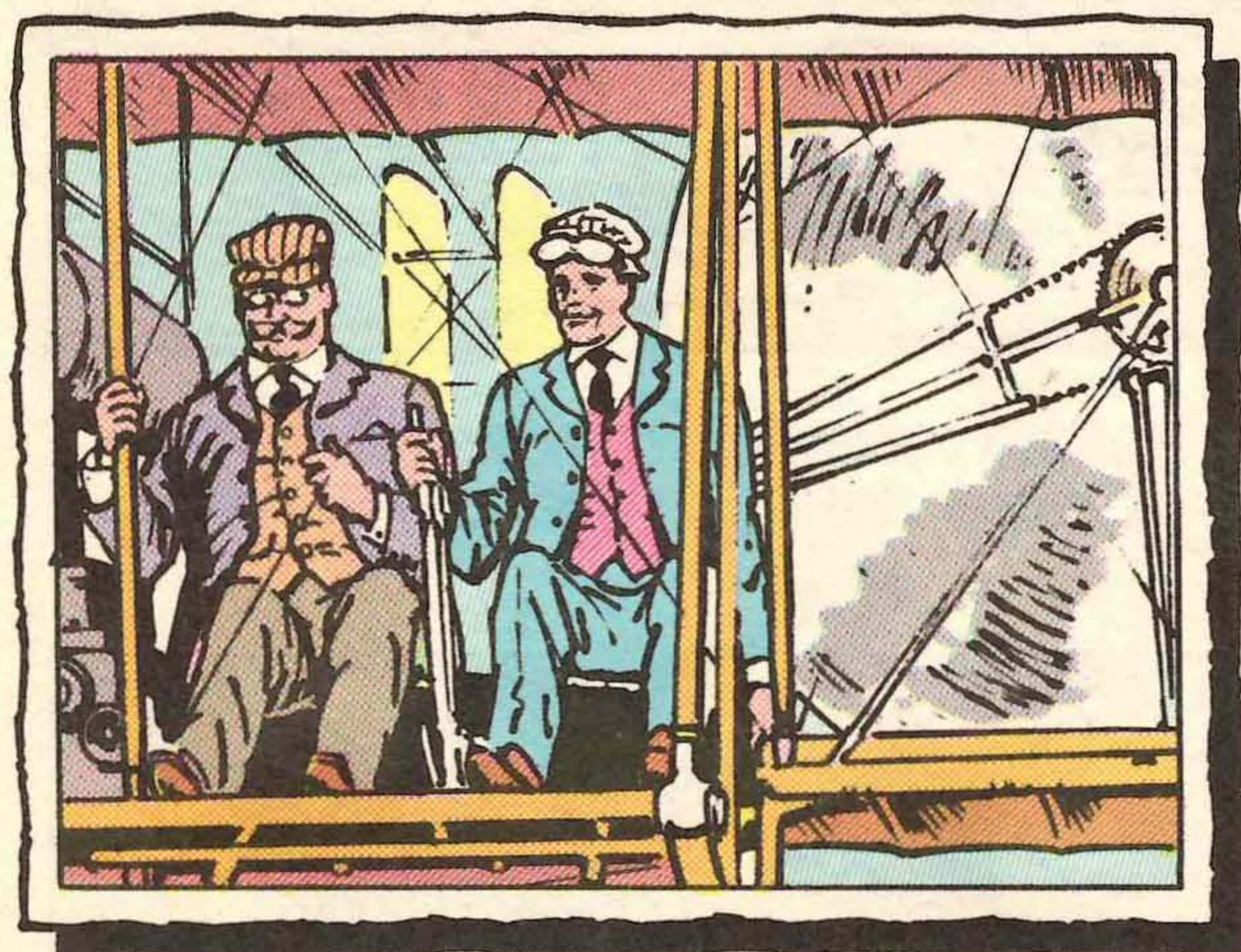
AERICAN ASTRONAUTS NEIL ARMSTRONG AND EDWIN ALDRIN SET THEIR SPACESHIP DOWN ON THE MOON'S SEA OF TRANQUILLITY IN 1969 — THE FIRST PEOPLE ON THE MOON!



THESE COURAGEOUS EXPLORERS WILLINGLY RISKED THEIR LIVES TO LEARN MORE ABOUT PLANET EARTH AND THE FAR REACHES OF SPACE — TO PAVE THE WAY FOR FUTURE GENERATIONS.



AMERICA'S SPACECRAFT FLIGHT TO THE MOON IN 1969 REALLY BEGAN AT A PLACE CALLED KILL DEVIL HILL NEAR KITTY HAWK, NORTH CAROLINA, ON THE MORNING OF DECEMBER 17, 1903. IT WAS THERE THAT ORVILLE WRIGHT FLEW HIS SIMPLE AIRCRAFT 120 FEET IN 12 SECONDS — THE FIRST POWERED FLIGHT!



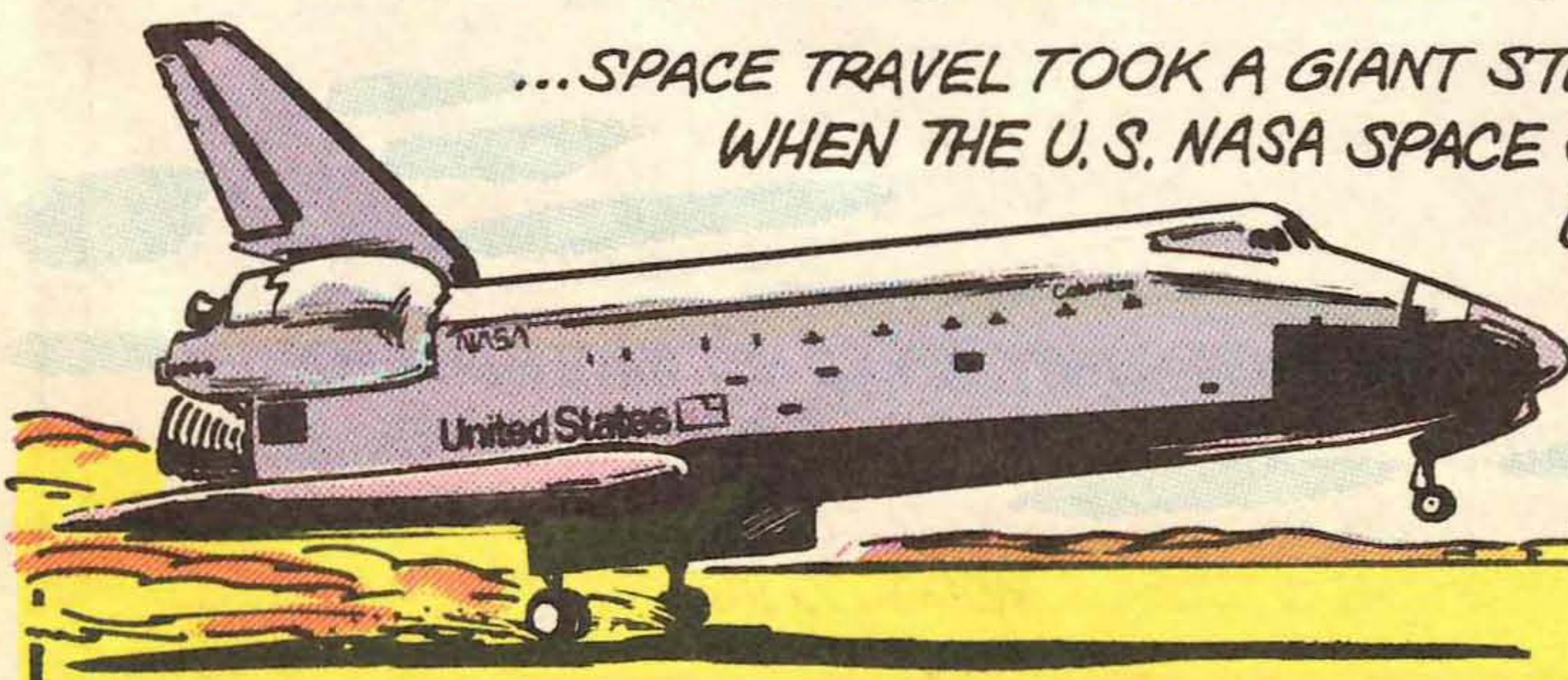
IN 1910, AT SPRINGFIELD, ILLINOIS, ONLY 7 YEARS AFTER THE VERY FIRST POWERED FLIGHT, THEODORE ROOSEVELT BUCKLED-UP IN THE OPEN-AIR PASSENGER'S SEAT OF A FLYING MACHINE AND BECAME THE FIRST U.S. PRESIDENT TO RIDE IN AN AIRPLANE. A YEAR LATER, THE PILOT LOST HIS LIFE IN A FLYING ACCIDENT.

TODAY, MILLIONS OF PEOPLE TRAVEL EVERY YEAR IN SLEEK JET AIRCRAFT TO AND FROM CITIES AROUND THE WORLD — AT AIRSPEEDS HUNDREDS OF MILES PER HOUR.



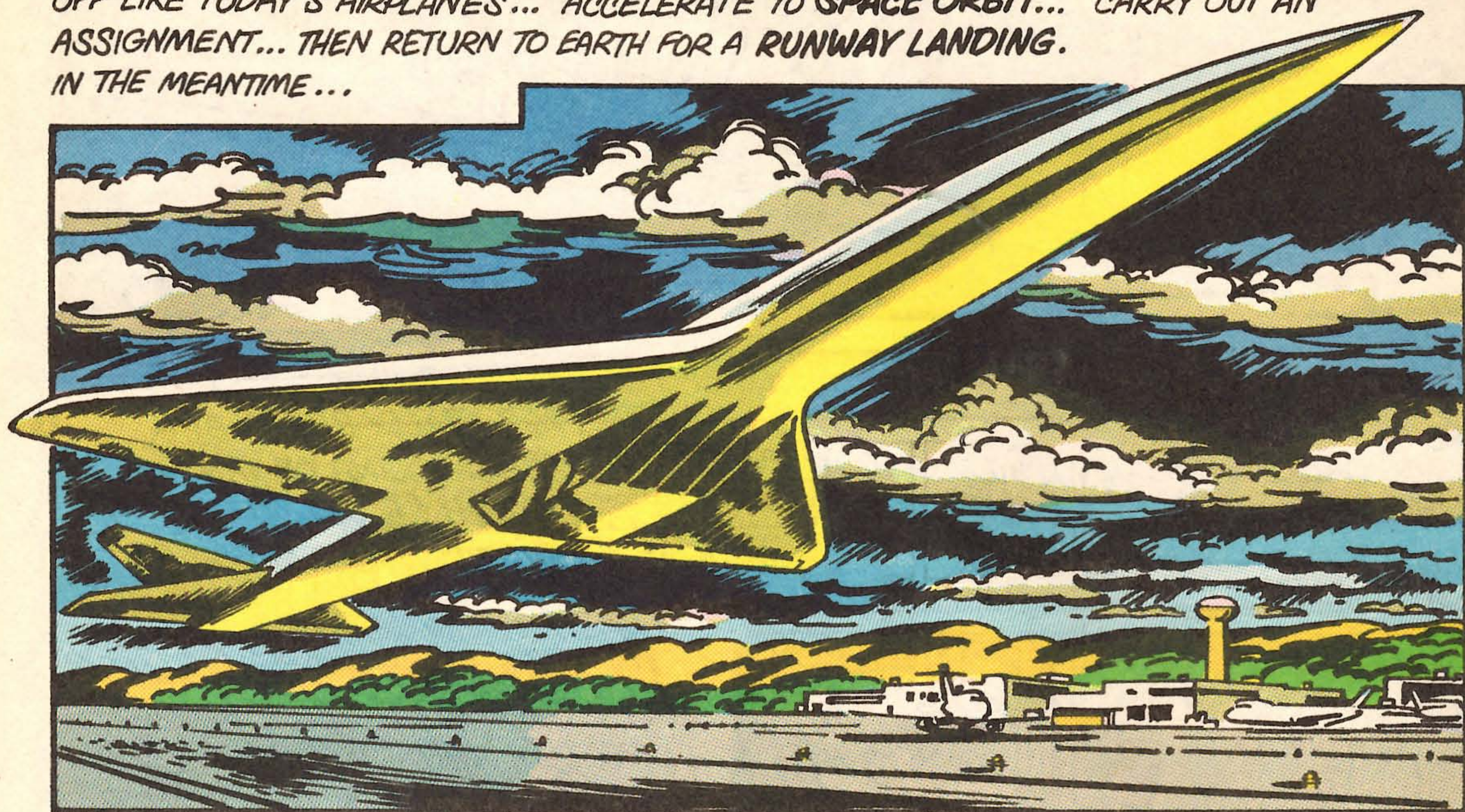
AMERICA'S SHUTTLE SPACECRAFT!

...SPACE TRAVEL TOOK A GIANT STEP FORWARD ON APRIL 14, 1981, WHEN THE U.S. NASA SPACE SHUTTLE COLUMBIA TOUCHED DOWN ON ROGERS DRY LAKE AT EDWARDS AIR FORCE BASE. IN CALIFORNIA — A PERFECT FLY-IN FROM SPACE!

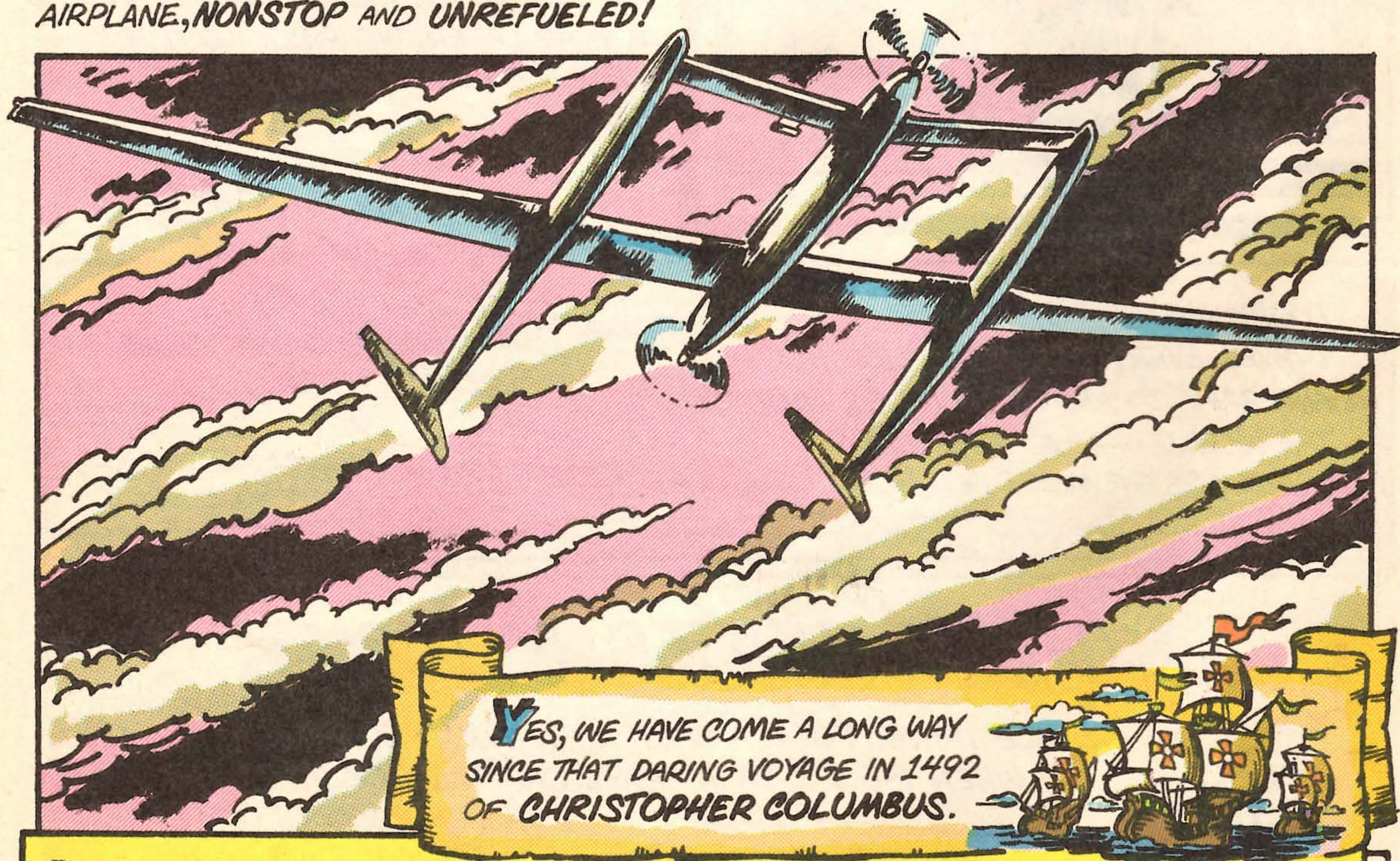


THE 200,000 POUND SPACESHIP WAS PILOTED BY U.S. ASTRONAUTS JOHN W. YOUNG AND ROBERT L. CRIPPEN

IMAGINE FLYING FROM NEW YORK TO TOKYO IN ONLY 2 HOURS! THE NATIONAL AEROSPACE PLANE PROGRAM (NASP) CAN LEAD TO MILITARY OR COMMERCIAL SPACEPLANES THAT TAKE OFF LIKE TODAY'S AIRPLANES... ACCELERATE TO SPACE ORBIT... CARRY OUT AN ASSIGNMENT... THEN RETURN TO EARTH FOR A RUNWAY LANDING. IN THE MEANTIME...

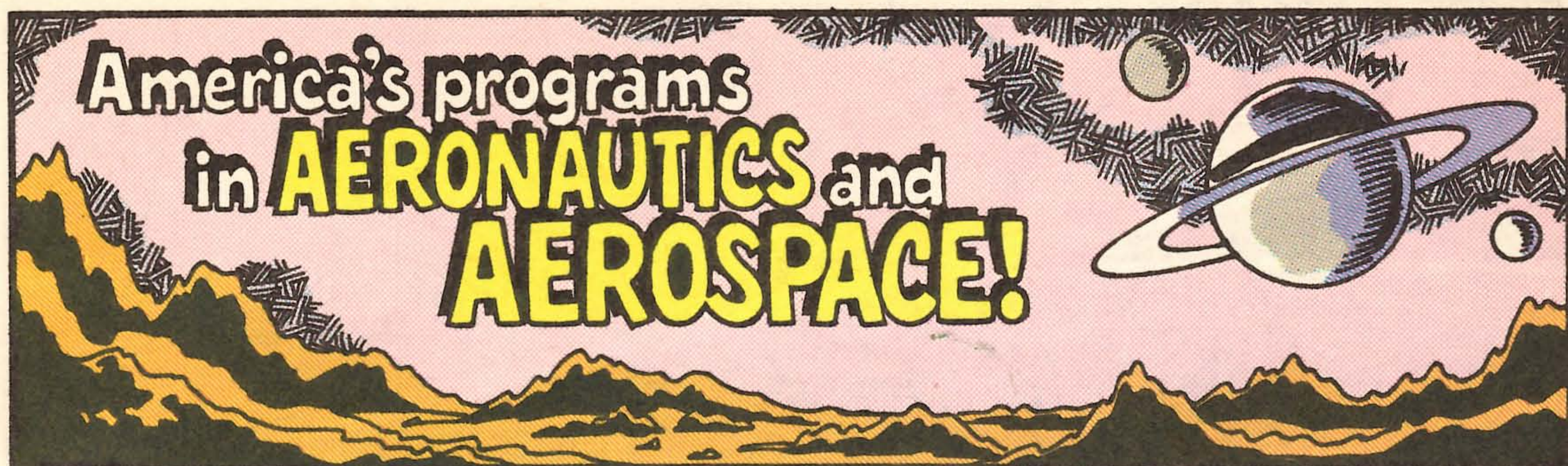


ON DECEMBER 23, 1986, AMERICAN PILOTS JEANNA YEAGER AND RICHARD RUTAN BECAME THE FIRST PEOPLE TO FLY AROUND THE WORLD IN VOYAGER, THEIR EXPERIMENTAL AIRPLANE, NONSTOP AND UNREFUELED!

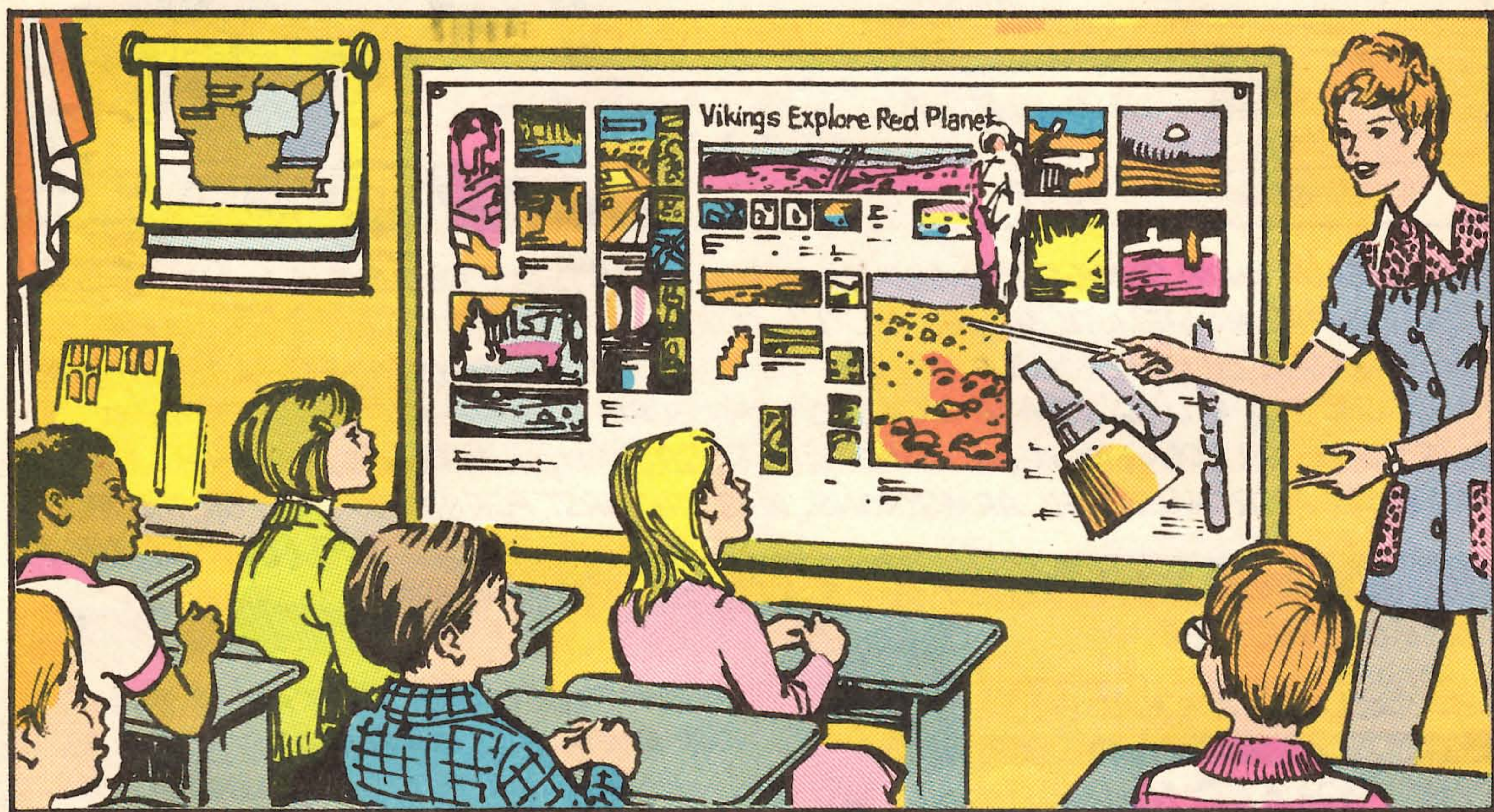


YES, WE HAVE COME A LONG WAY SINCE THAT DARING VOYAGE IN 1492 OF CHRISTOPHER COLUMBUS.

LIKE MANY MODES OF TRAVEL TODAY, THIS EPOCH FLIGHT WOULD NOT HAVE BEEN POSSIBLE WITHOUT **ELECTRICITY/ELECTRONICS**. THE VOYAGER TOOK 9 DAYS, 3 MINUTES AND 44 SECONDS TO TRAVEL 25,012 MILES AT AN AVERAGE SPEED OF 116 MILES PER HOUR. PRESIDENT REAGAN PRESENTED THE PRESIDENTIAL CITIZEN'S MEDAL TO THE INTREPID "VOYAGERS."



America's programs in **AERONAUTICS** and **AEROSPACE!**

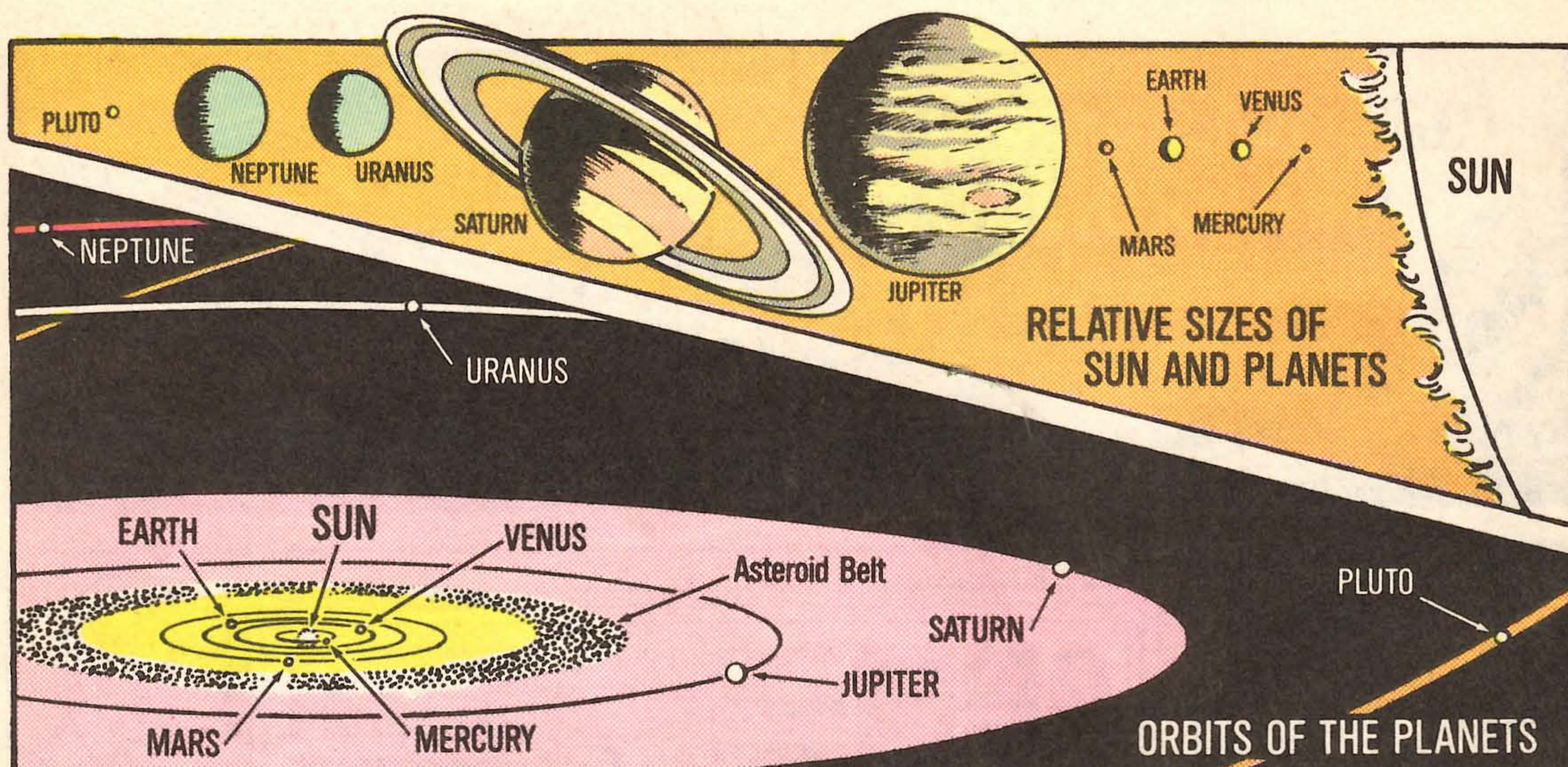


THE RESEARCH AND SPACE EXPLORATION PROGRAMS OF AMERICA'S NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) HAVE GREATLY INCREASED OUR KNOWLEDGE ABOUT PLANET EARTH AND OTHER PLANETS IN OUR SOLAR SYSTEM.





NEXT...
A WINDOW TO OUTER SPACE!

IT HAS TAKEN ASTRONOMERS AND OTHER PEOPLE OF SCIENCE COUNTLESS CENTURIES TO GAIN THE KNOWLEDGE WE HAVE TODAY. A SPIN-OFF OF THE NASA SPACE PROGRAM WILL GIVE THEM A NEW, INCREDIBLE WINDOW TO OUTER SPACE WHEN AMERICA'S SPACE SHUTTLE PLACES A POWERFUL TELESCOPE IN ORBIT.



YOU ALREADY KNOW SOME FACTS ABOUT OUR SOLAR SYSTEM... ABOUT THE PLANET EARTH ... THAT IT HAS A SATELLITE CALLED MOON... THAT EARTH IS TRAVELLING IN REGULAR ORBIT AROUND THE SUN, COMPLETING ONE TRIP EVERY $365\frac{1}{4}$ DAYS (ONE YEAR). AND, YOU KNOW ABOUT AMERICA'S NASA EXPLORER SPACECRAFT AND THEIR FLIGHTS TO OTHER PLANETS IN OUR SOLAR SYSTEM... LIKE VENUS, SATURN, JUPITER AND MARS... THAT AN AMERICAN ASTRONAUT, NEIL ARMSTRONG, WAS THE FIRST PERSON TO LAND ON THE MOON (JULY 20, 1969).

SPACE SHUTTLE 
283 MILES PER MINUTE!

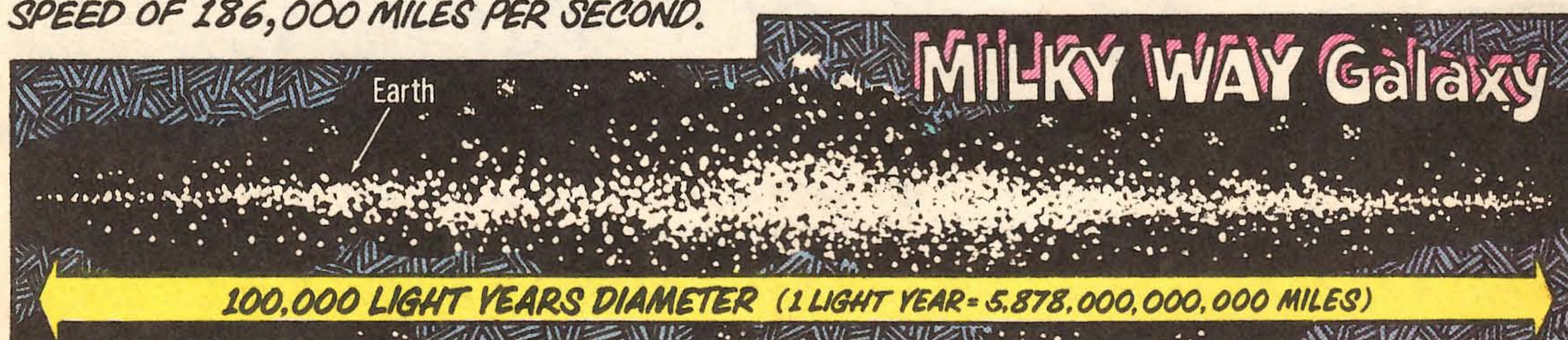
PIONEER 10 
509 MILES PER MINUTE!

"Spaceship" EARTH
8400
MILES PER MINUTE!

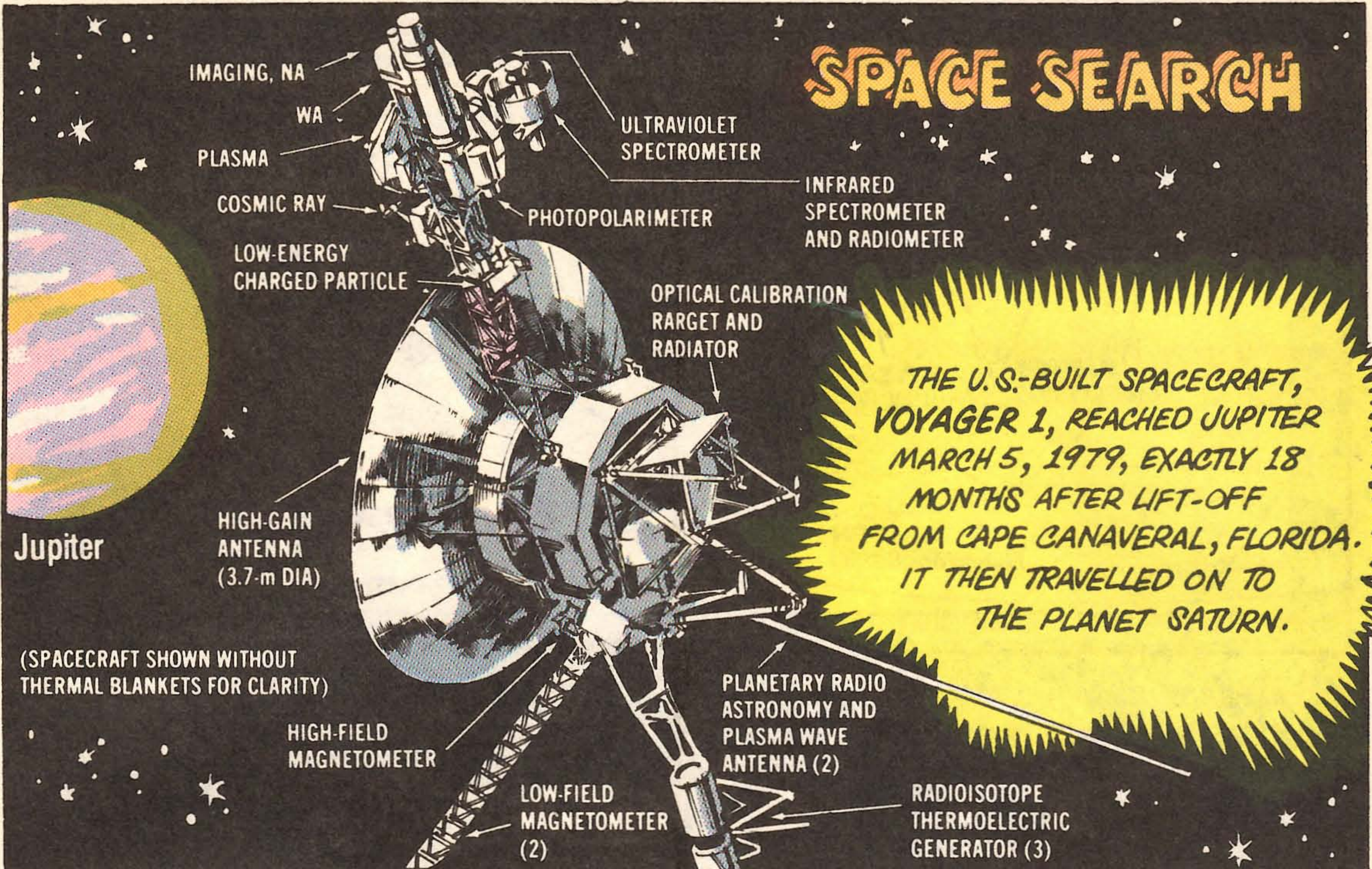
BUT, HAVE YOU THOUGHT ABOUT THIS?
OUR EARTH IS ALSO A KIND OF SPACESHIP...
A SPACESHIP WITH PASSENGERS!
ASTRONOMERS SAY THAT THE EARTH IS
TRAVELLING AT A SPEED OF 8,400 MILES
PER MINUTE, INSIDE A SUPER-GIANT
SPACE BODY — A SPIRAL-ARMED
GALAXY CALLED THE MILKY WAY!



THE FLAT, DISK-SHAPED MILKY WAY GALAXY TAKES ABOUT 200 MILLION YEARS TO COMPLETE ONE ROTATION. ASTRONOMERS THINK THAT IT MAY CONTAIN 100 BILLION STARS; AND THAT OUR EARTH IS ABOUT 30,000 LIGHT YEARS FROM THE GALAXY'S CENTER. INCIDENTALLY, A LIGHT YEAR IS THE DISTANCE THAT LIGHT TRAVELS IN ONE YEAR AT A SPEED OF 186,000 MILES PER SECOND.

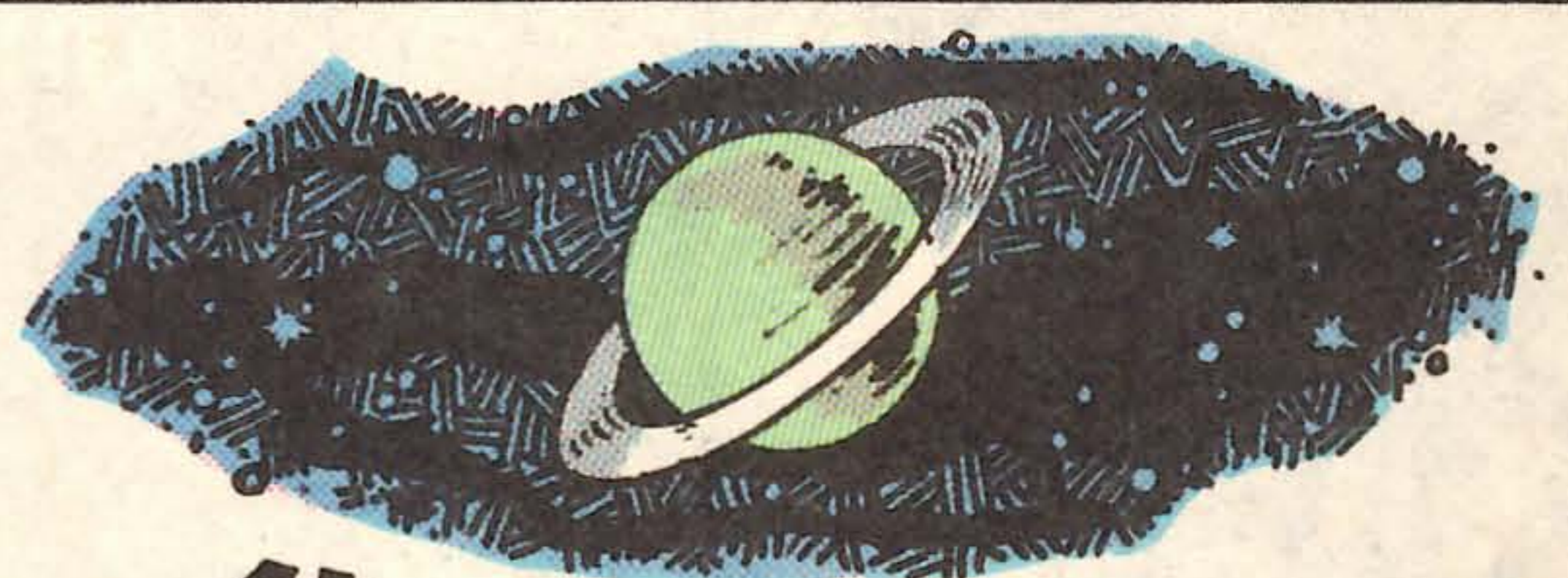


SPACE SEARCH

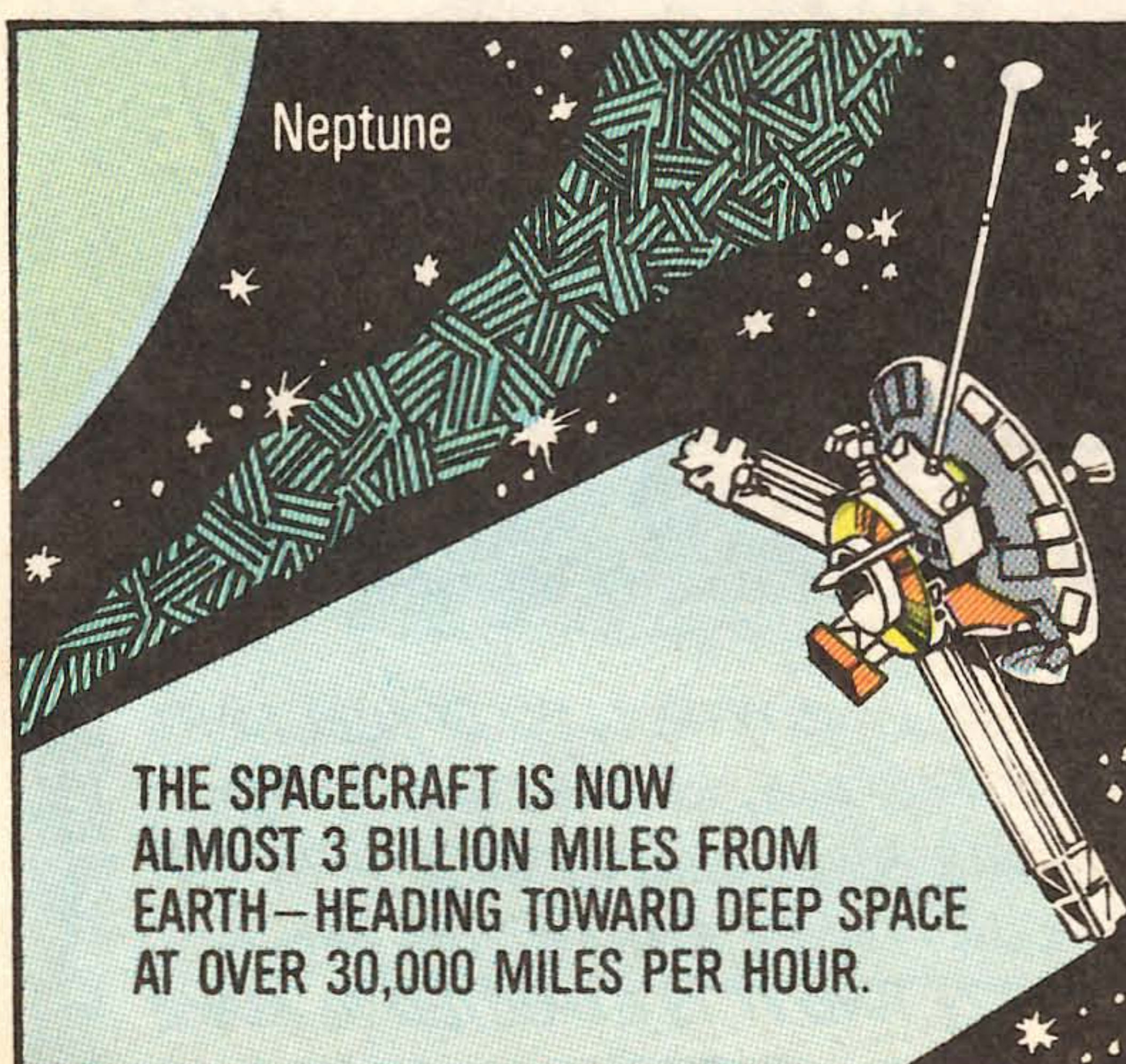


THE U.S.-BUILT SPACECRAFT, VOYAGER 1, REACHED JUPITER MARCH 5, 1979, EXACTLY 18 MONTHS AFTER LIFT-OFF FROM CAPE CANAVERAL, FLORIDA. IT THEN TRAVELLED ON TO THE PLANET SATURN.

THE UNMANNED SPACECRAFT VOYAGER 2 LEFT EARTH ON AUGUST 20, 1977 AND PASSED BY THE PLANET URANUS IN JANUARY 1986, AFTER TRAVELLING OVER A BILLION MILES. THE SPACECRAFT SENT BACK PICTURES WHICH GAVE EARTH PEOPLE THE FIRST CLOSE-UP LOOK AT URANUS, THE THIRD MOST DISTANT PLANET IN OUR SOLAR SYSTEM.



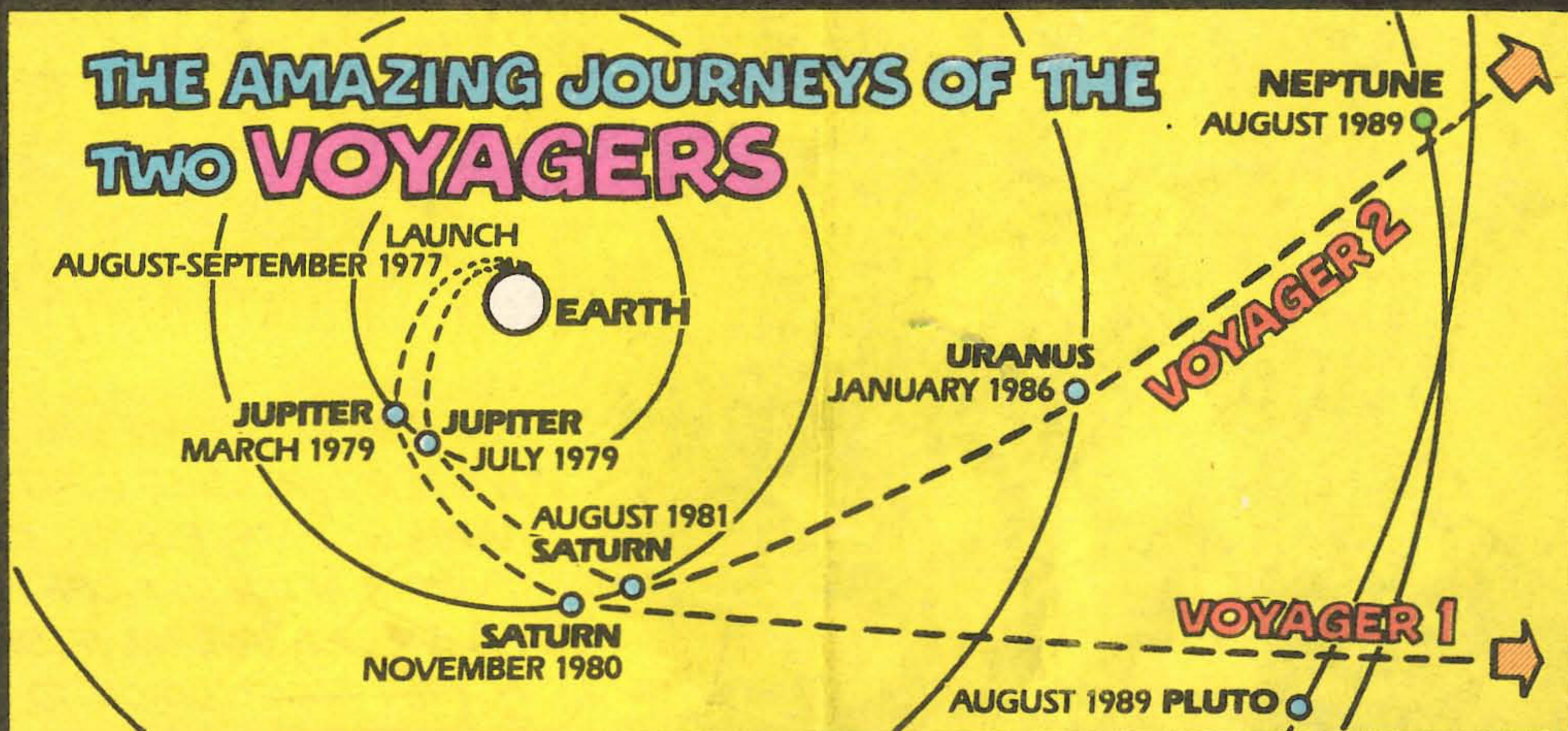
URANUS IS SO FAR AWAY THAT LIGHT FROM THE SUN, MOVING AT 186,000 MILES PER SECOND, TAKES TWO AND ONE-HALF HOURS TO REACH THE PLANET.



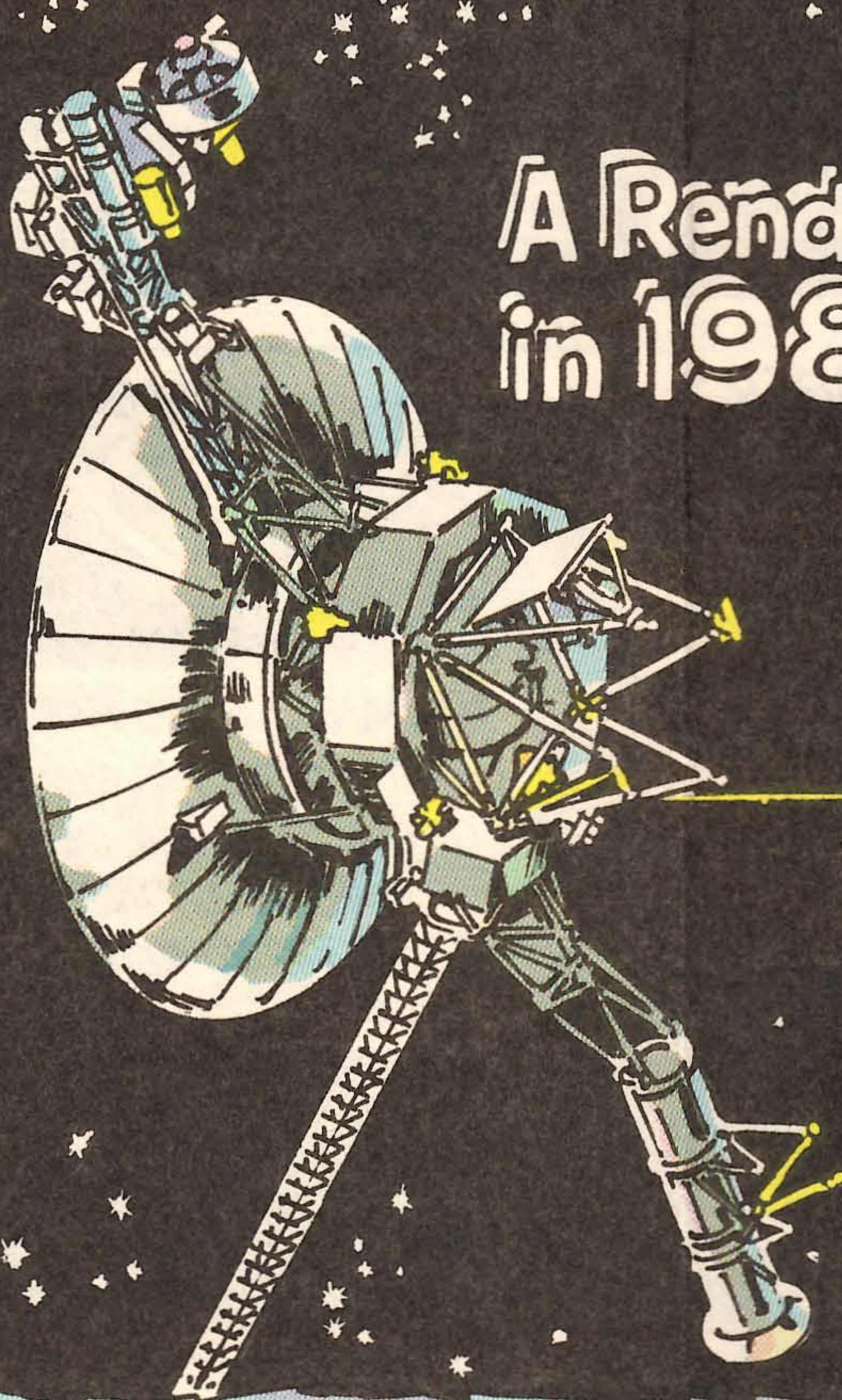
PIONEER 10 CONTAINS A MESSAGE ABOUT HUMAN KNOWLEDGE AND LIFE ON OUR PLANET EARTH, ETCHED ON A GOLD-ANODIZED ALUMINUM PLATE, IN THE EVENT THAT IT IS INTERCEPTED BY BEINGS FROM ANOTHER WORLD.

AMERICA'S EXPLORER SPACECRAFT ARE CROSSING NEW FRONTIERS OF INTERSTELLAR SPACE. ON JUNE 13, 1983, PIONEER 10 SPED PAST THE PLANET NEPTUNE, THE LAST OUTPOST IN OUR SOLAR SYSTEM, AND HEADED FOR DEEP SPACE—STILL SENDING DATA BACK TO U.S. SCIENTISTS ON EARTH. IT WAS LAUNCHED ON MARCH 3, 1972.

THE AMAZING JOURNEYS OF THE TWO VOYAGERS

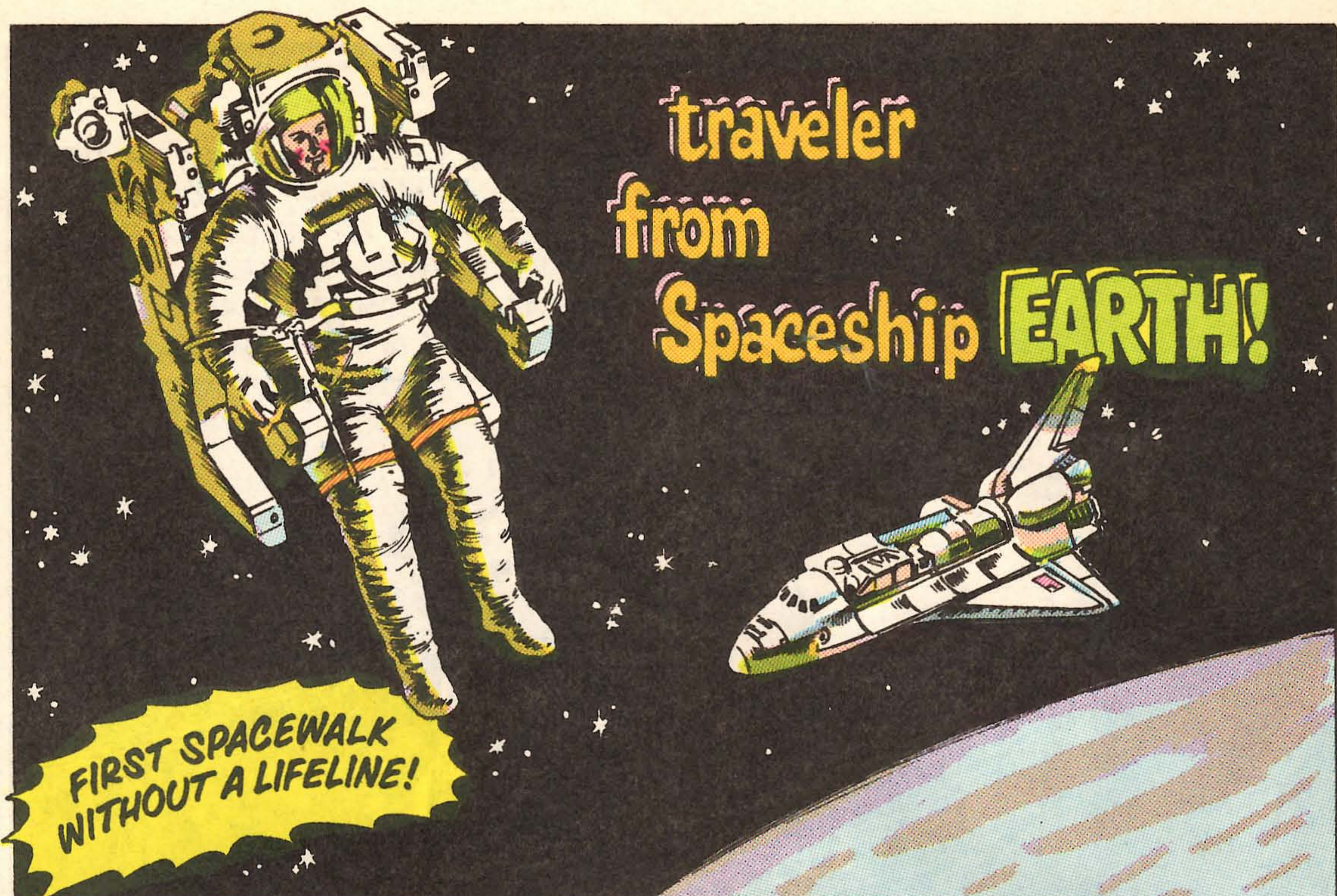


A Rendezvous in 1989...



NEPTUNE

EVEN AS YOU READ THESE WORDS, AN ELECTRONICALLY-CONTROLLED SPACECRAFT, SURROUNDED BY THE BITTER COLD AND BLACKNESS OF SPACE, IS COASTING ALONG AT A SPEED OF 40,000 MILES PER HOUR AS IT HEADS FOR A RENDEZVOUS WITH THE EIGHTH PLANET IN A SOLAR SYSTEM THAT INCLUDES OUR PLANET EARTH. THE SPACECRAFT, U.S. VOYAGER 2, LEFT EARTH AUGUST 20, 1977; AND IT IS EXPECTED TO MAKE A CLOSE PASS BY THE DISTANT PLANET NEPTUNE AUGUST 24, 1989. THE PHOTOS IT SENDS BACK TO EARTH WILL HELP US TO LEARN EVEN MORE ABOUT OUR SOLAR SYSTEM ——— AND HOW IT BEGAN.



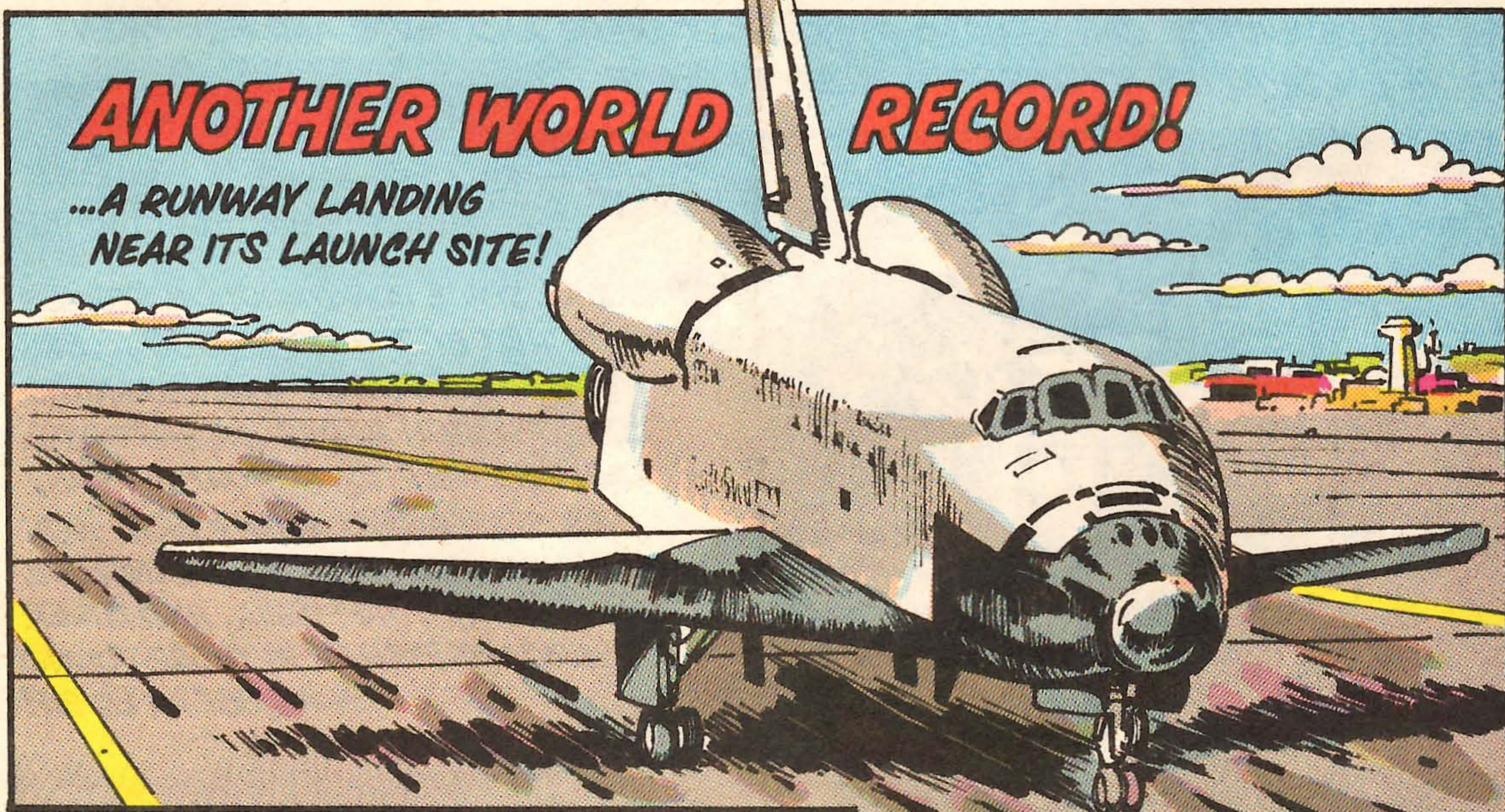
traveler
from
Spaceship **EARTH!**

**FIRST SPACEWALK
WITHOUT A LIFELINE!**

ON DAY FIVE OF THE SPACE SHUTTLE **CHALLENGER'S** MISSION IN FEBRUARY 1984, AMERICAN ASTRONAUT **BRUCE McCANDLESS** BECAME THE FIRST EARTH PERSON TO TRAVEL IN SPACE WITHOUT A LIFELINE, WEARING A HAND-CONTROLLED MMU (MANNED MANEUVERING UNIT) PROPELLED BY COMPRESSED NITROGEN ... RELEASED THROUGH TINY THRUSTERS.
— YES, WE HAVE A REASON TO BE PROUD OF OUR COUNTRY!

ANOTHER WORLD RECORD!

...A RUNWAY LANDING
NEAR ITS LAUNCH SITE!

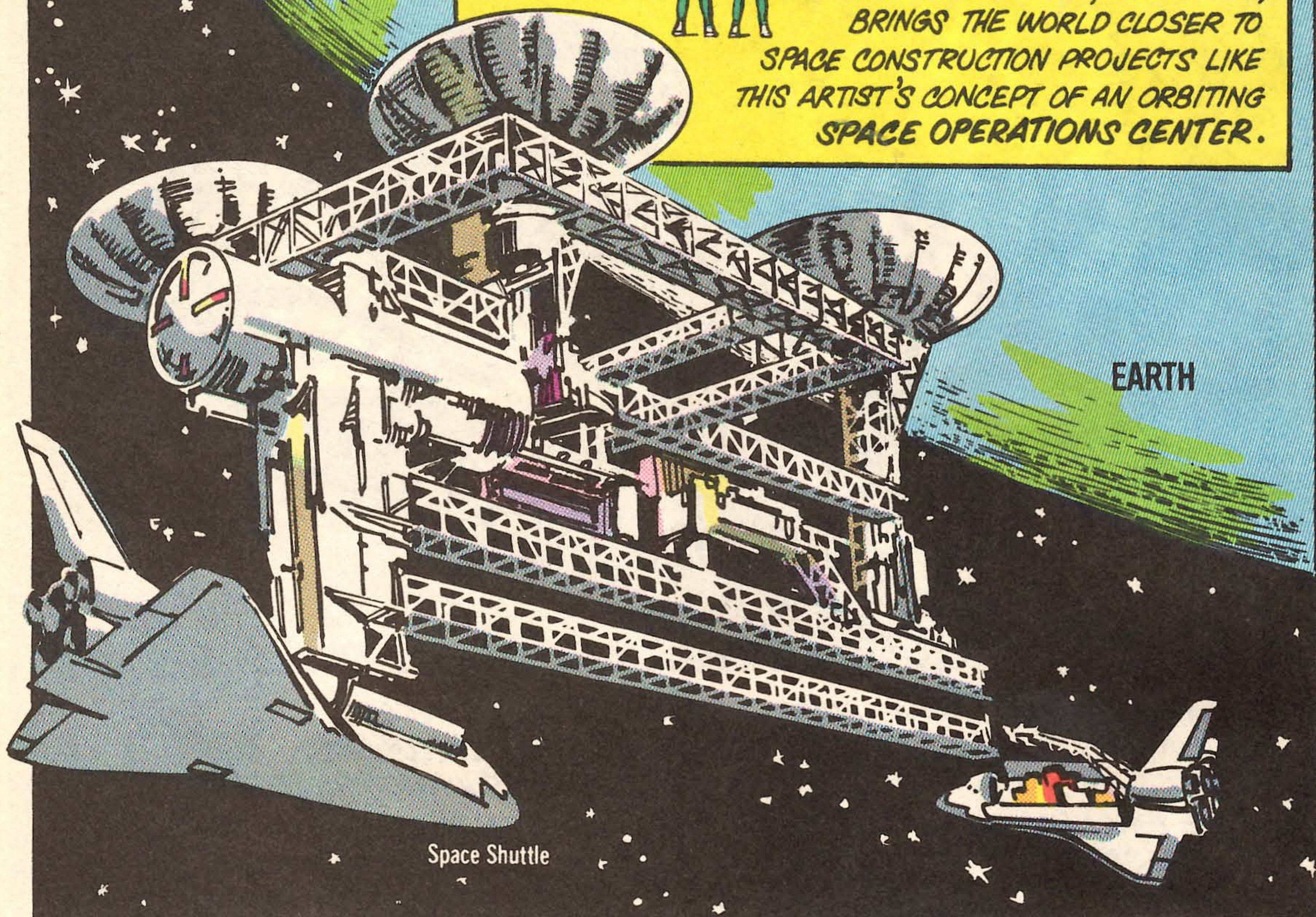


FLYING IN FROM SPACE TO THE SITE OF ITS LAUNCHING, THE SPACE SHUTTLE **CHALLENGER** WAS EASED DOWN FOR A PERFECT RUNWAY LANDING AT CAPE CANAVERAL, FLORIDA. THE SPACECRAFT WAS PILOTED BY ROBERT GIBSON. VANCE BRAND WAS MISSION COMMANDER.

ASTROWORKERS

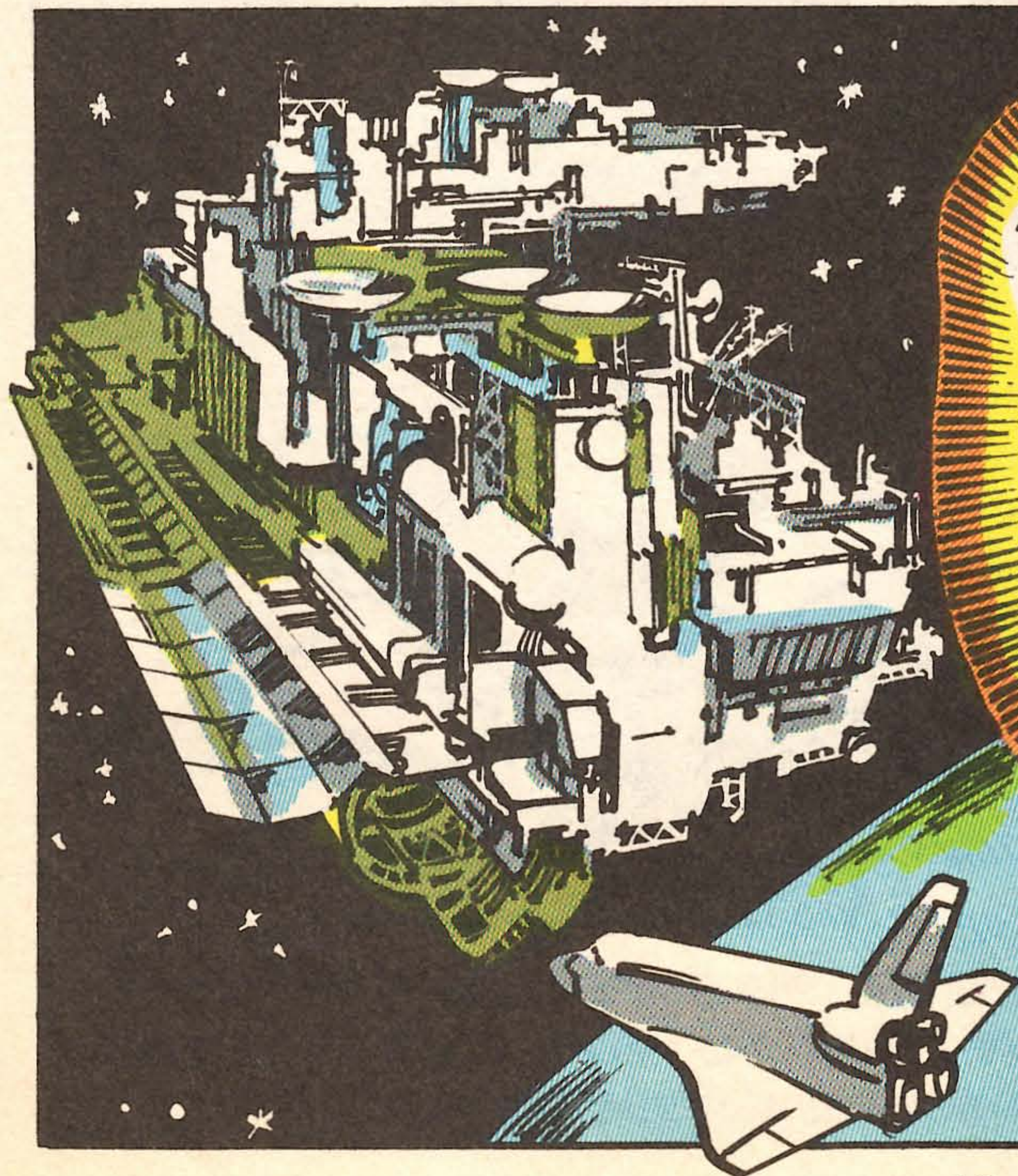


THE SUCCESSFUL FLIGHT OF THE U.S. SPACE SHUTTLE, COLUMBIA, BRINGS THE WORLD CLOSER TO SPACE CONSTRUCTION PROJECTS LIKE THIS ARTIST'S CONCEPT OF AN ORBITING SPACE OPERATIONS CENTER.



Space Shuttle

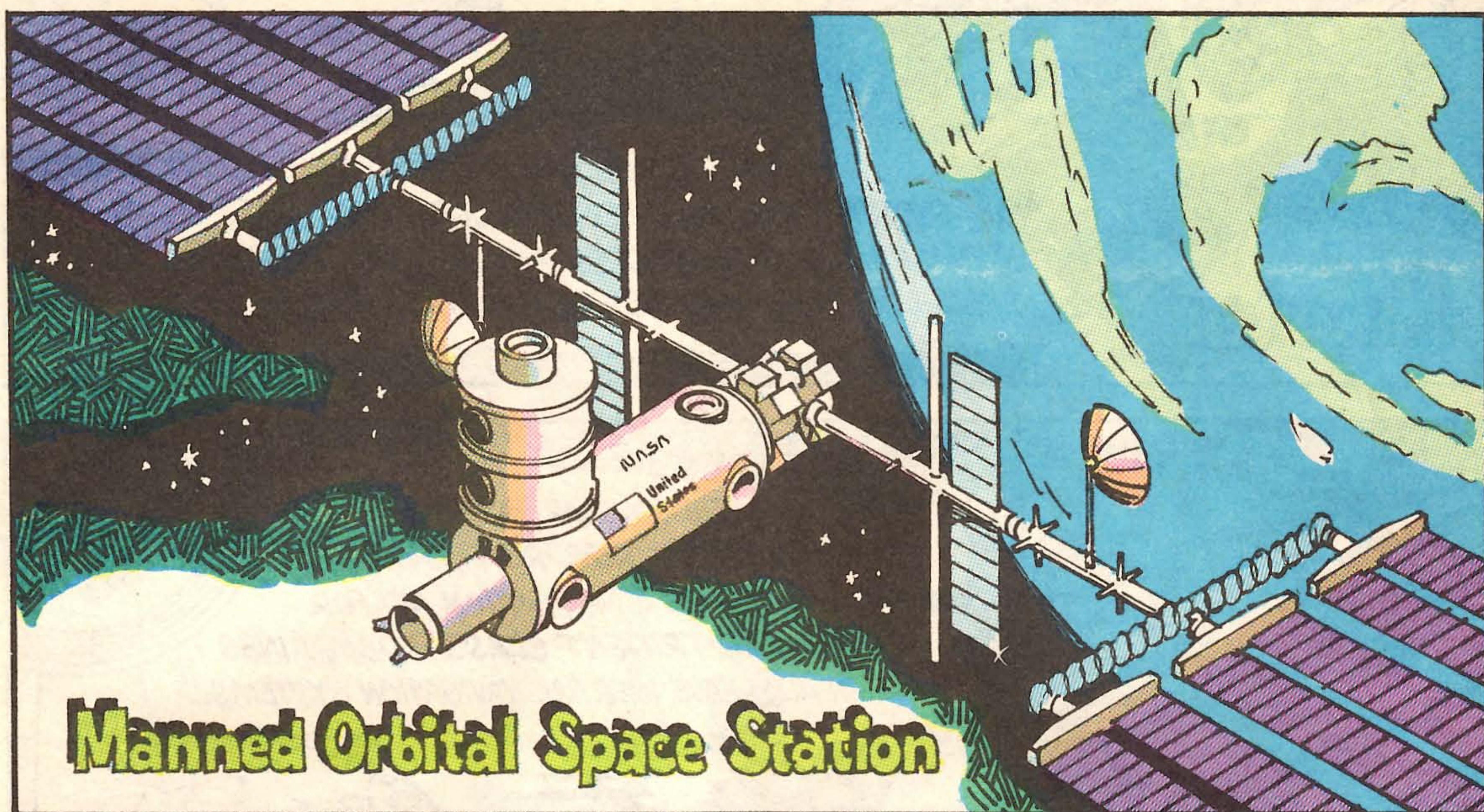
THE SPACE SHUTTLE CAN BE USED TO FERRY WORKERS AND PARTS AND EQUIPMENT FROM EARTH TO THE CONSTRUCTION SITES IN SPACE.



PRESENT SPACE CONSTRUCTION STUDIES INDICATE THAT BY THE YEAR 2000... LESS THAN TWO DECADES AWAY... MANNED CONSTRUCTION BASES, OR FACTORIES, WILL BE ABLE TO SUPPORT AS MANY AS 500 "ASTROWORKERS" WITH LIVING SECTIONS WHICH WILL INCLUDE A MOTEL, CAFETERIA, AND OTHER SERVICES SIMILAR TO THOSE FOUND ON AN OCEAN LINER!

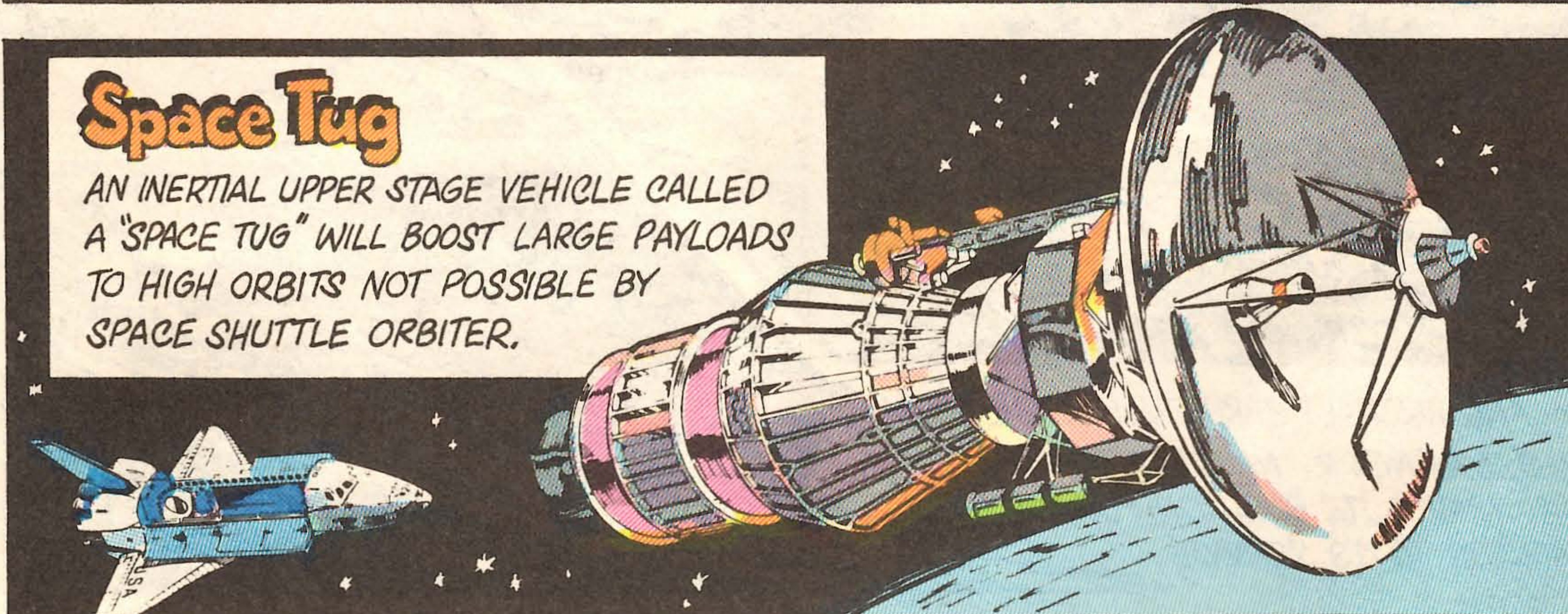
EARTH

BELOW IS AN ARTIST'S CONCEPTION OF A NASA MANNED ORBITAL SPACE STATION CONSISTING OF MODULES FOR HOUSING, AND FOR STORAGE/WORK AREAS. IT WOULD SERVE AS A CONTROL CENTER FOR CIVIL AND MILITARY SPACE OPERATIONS.



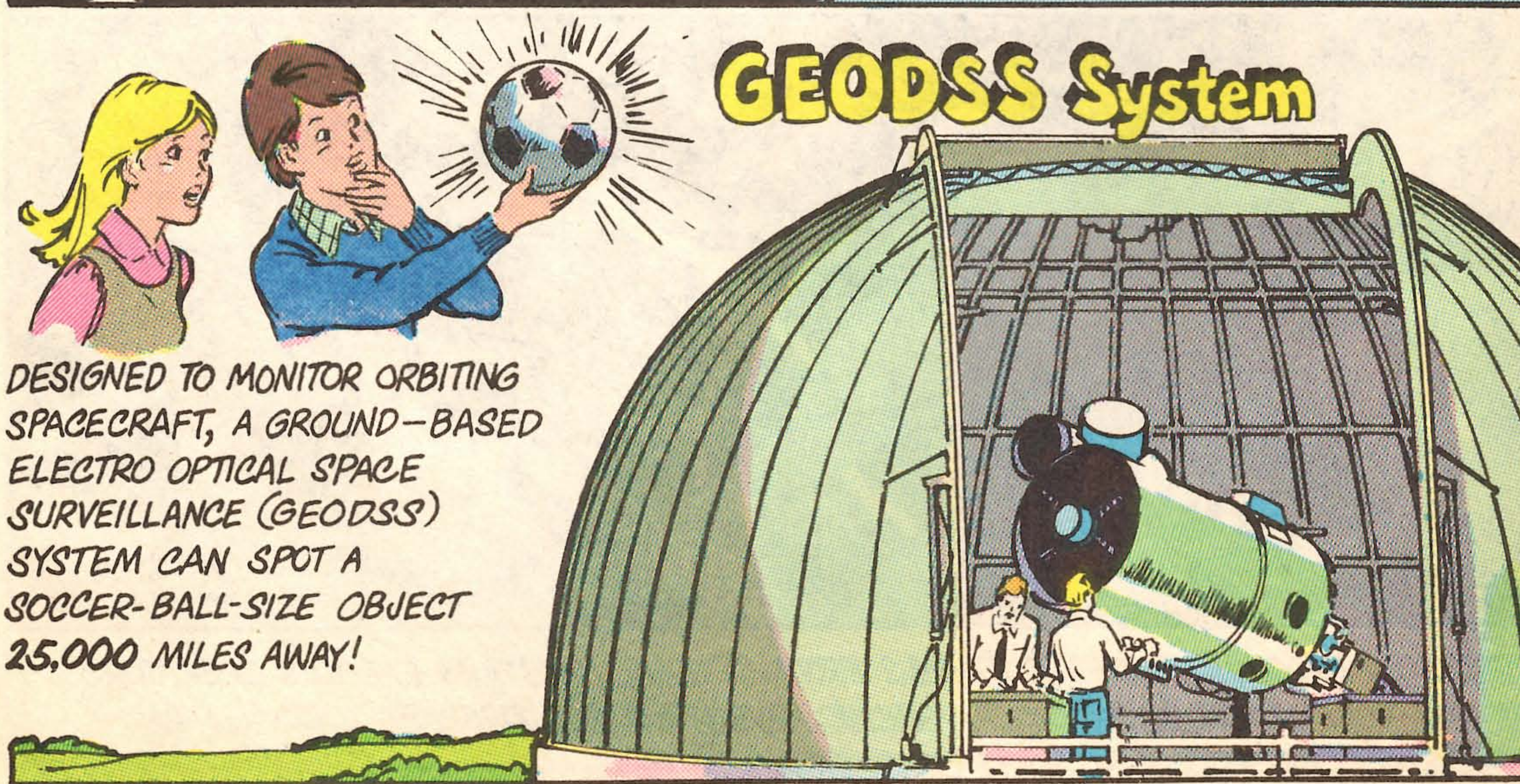
Space Tug

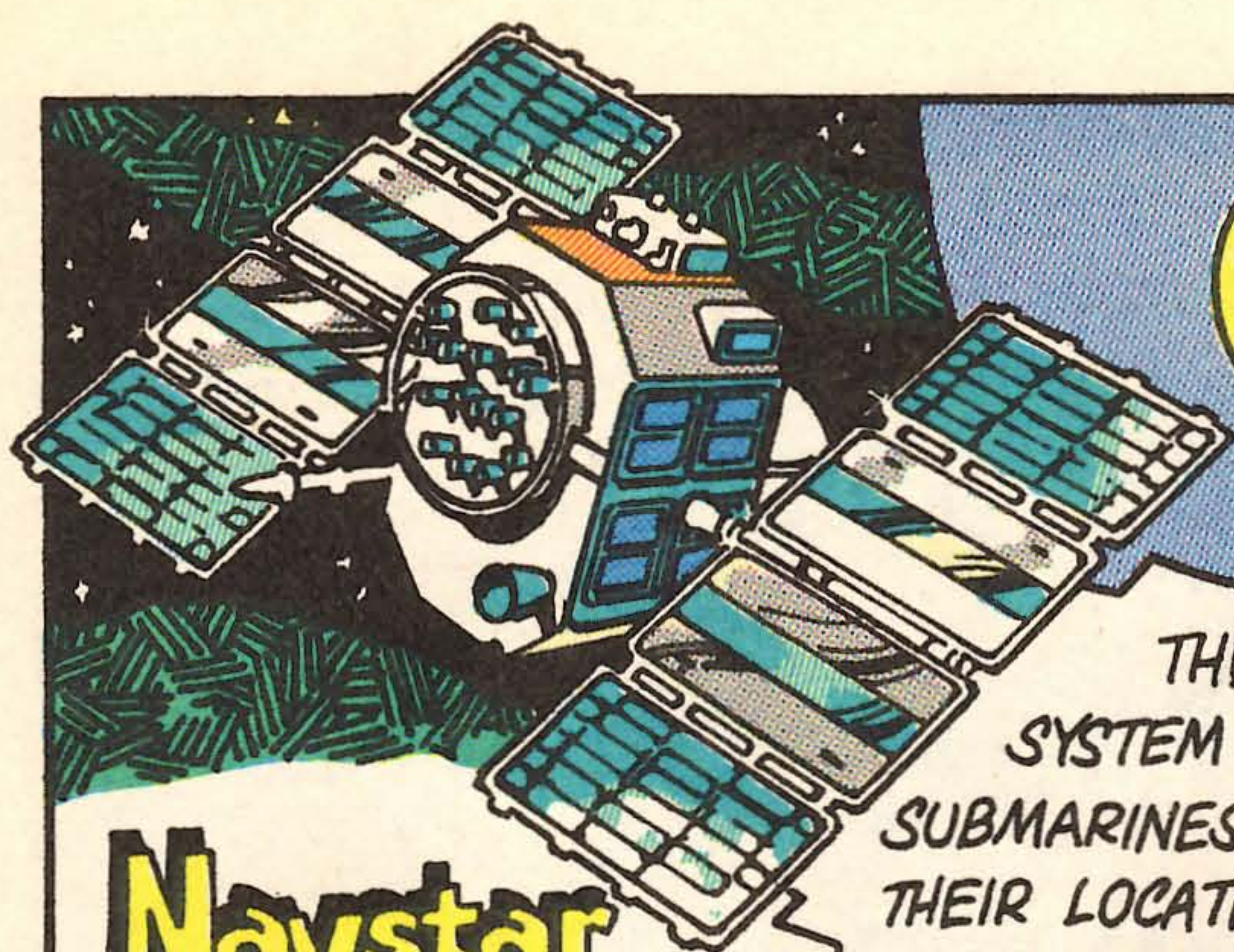
AN INERTIAL UPPER STAGE VEHICLE CALLED A "SPACE TUG" WILL BOOST LARGE PAYLOADS TO HIGH ORBITS NOT POSSIBLE BY SPACE SHUTTLE ORBITER.



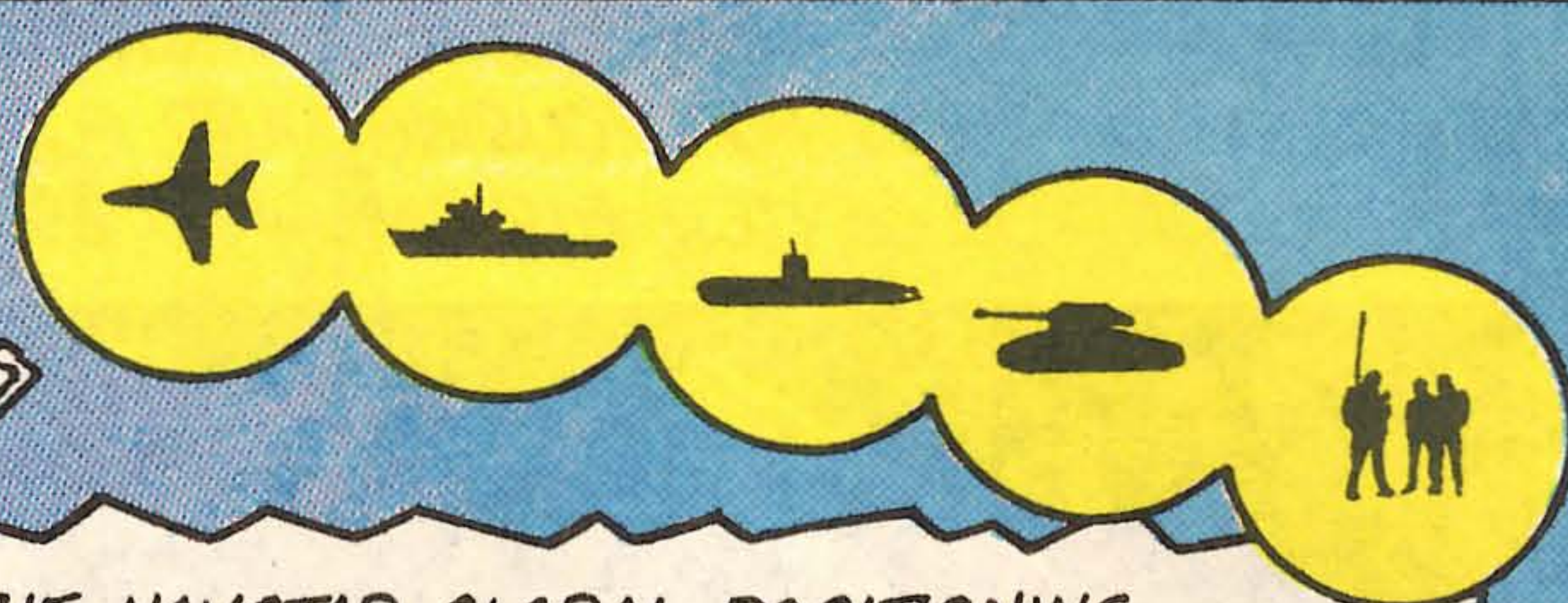
GEODSS System

DESIGNED TO MONITOR ORBITING SPACECRAFT, A GROUND-BASED ELECTRO OPTICAL SPACE SURVEILLANCE (GEODSS) SYSTEM CAN SPOT A SOCCER-BALL-SIZE OBJECT 25,000 MILES AWAY!

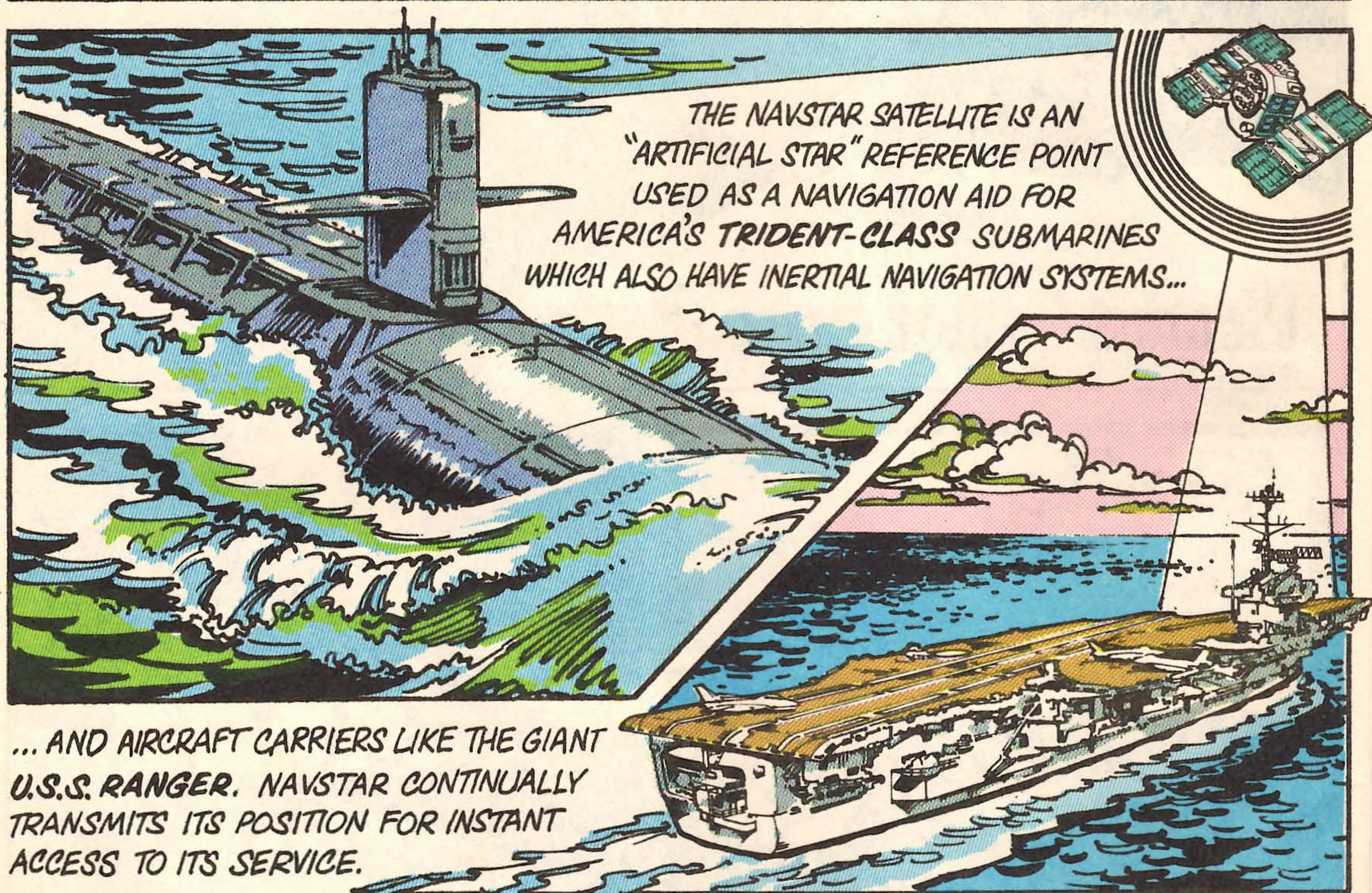




Navstar

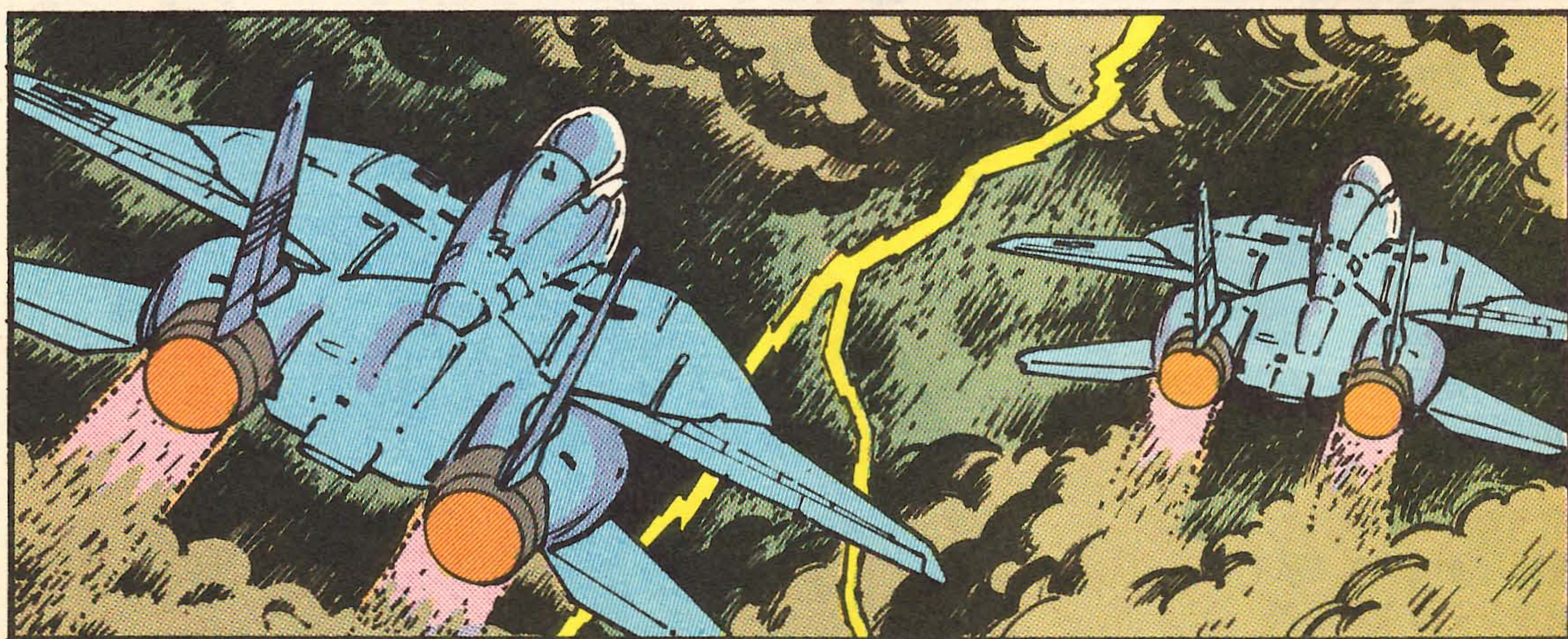


THE NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) ENABLES OPERATORS OF AIRCRAFT, SHIPS, SUBMARINES, LAND VEHICLES AND GROUND TROOPS TO FIND THEIR LOCATIONS AND ALTITUDE WITHIN **50** FEET!



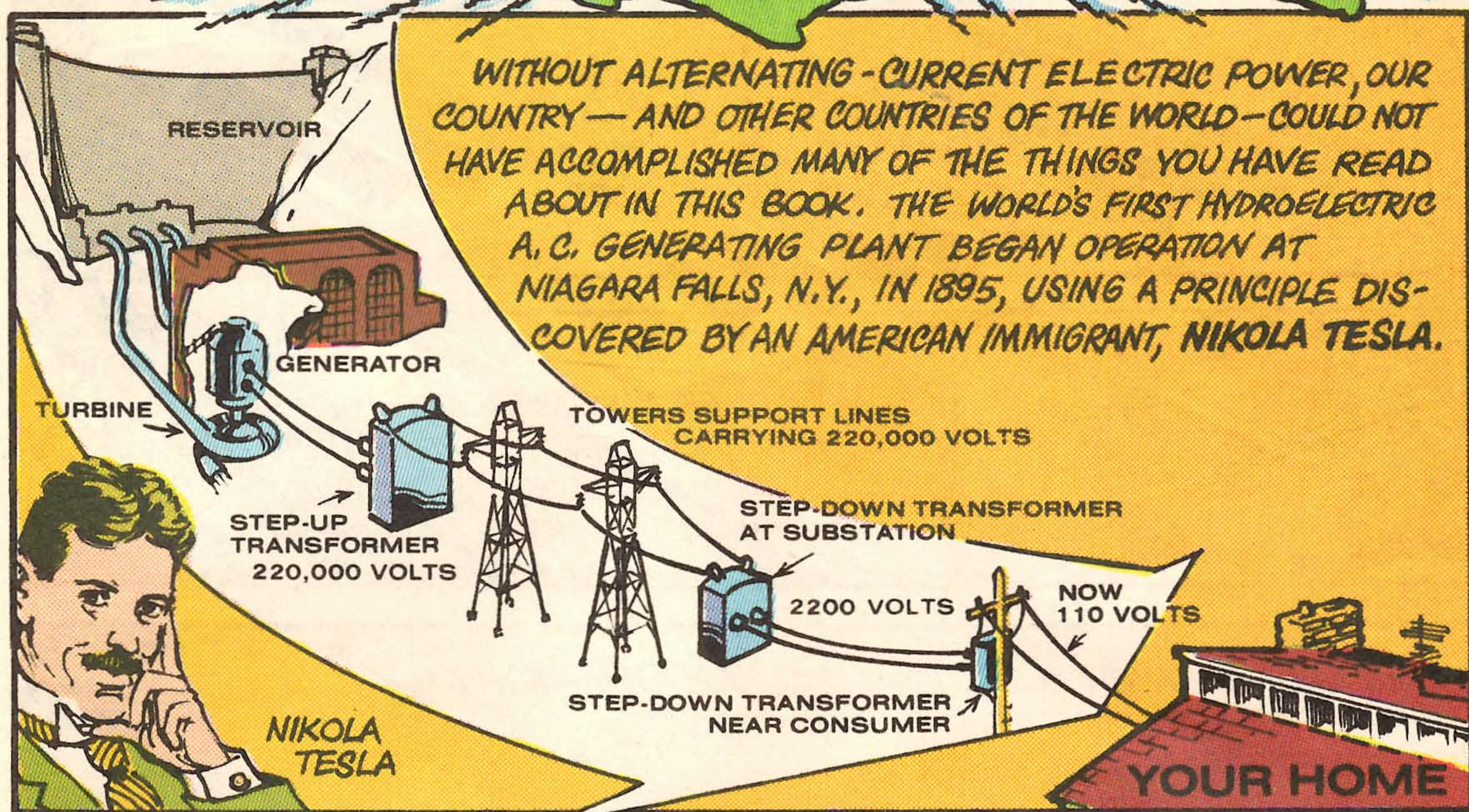
THE NAVSTAR SATELLITE IS AN "ARTIFICIAL STAR" REFERENCE POINT USED AS A NAVIGATION AID FOR AMERICA'S TRIDENT-CLASS SUBMARINES WHICH ALSO HAVE INERTIAL NAVIGATION SYSTEMS...

... AND AIRCRAFT CARRIERS LIKE THE GIANT U.S.S. RANGER. NAVSTAR CONTINUALLY TRANSMITS ITS POSITION FOR INSTANT ACCESS TO ITS SERVICE.



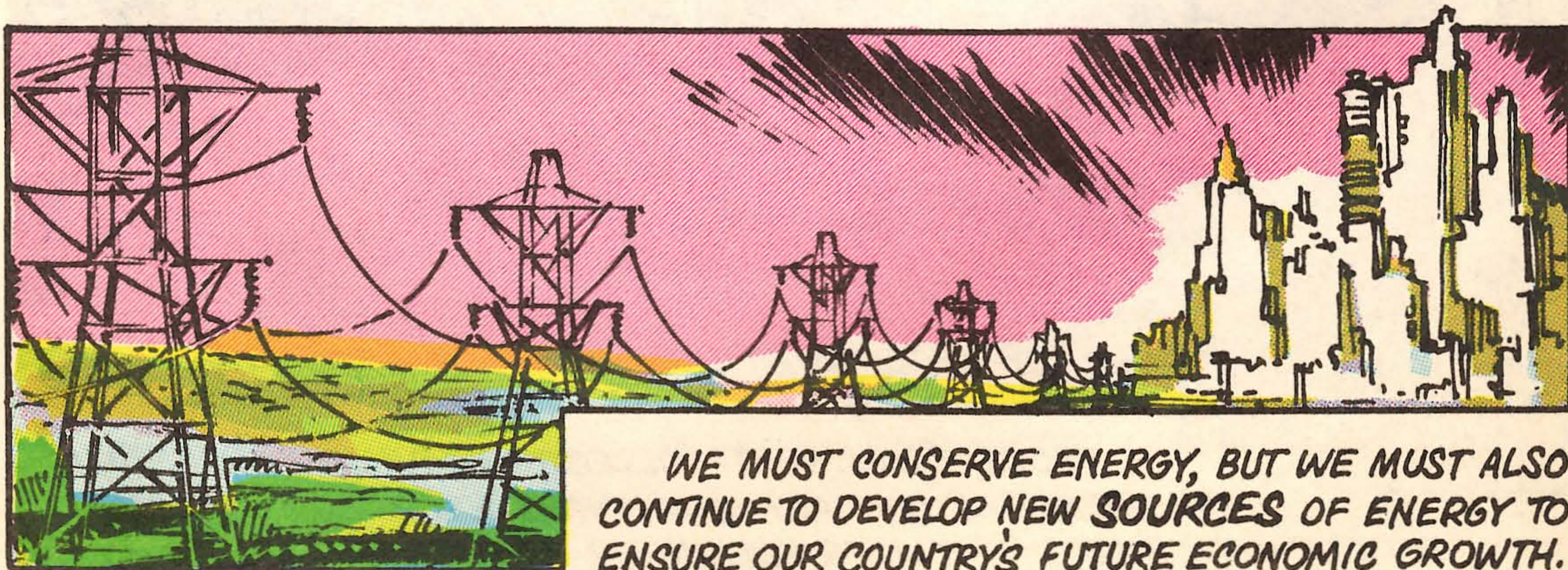
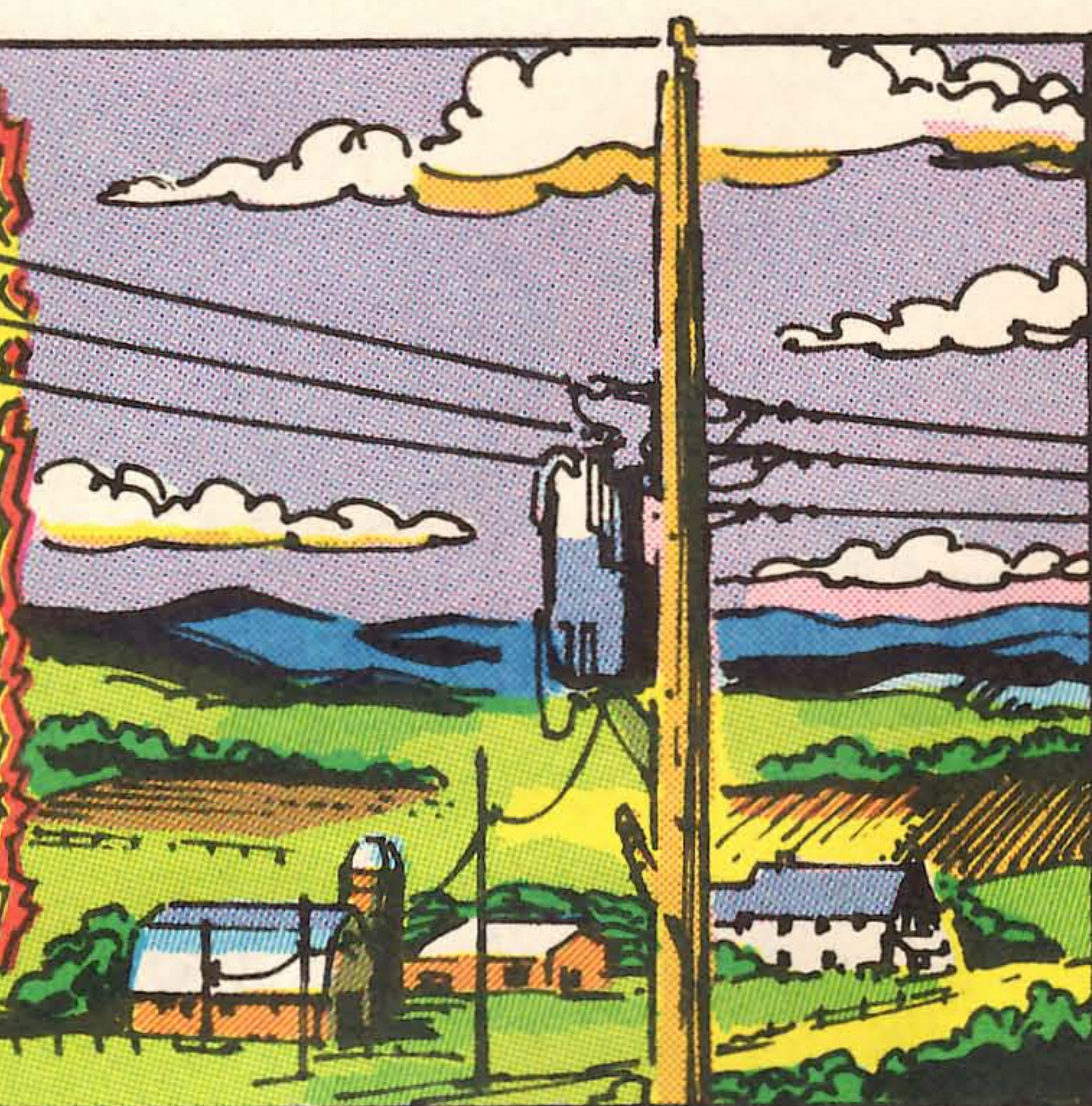
COMPUTER PROCESSING OF THE SIGNALS FROM SEVERAL NAVSTARS ENABLES OPERATORS TO PIN-POINT THEIR LOCATION... A GREAT ADVANTAGE FOR AIRCRAFT ENGAGED IN PRECISION OPERATIONS AT NIGHT OR IN BAD WEATHER.

America's **ELECTRIC POWER**



POWER LINES...

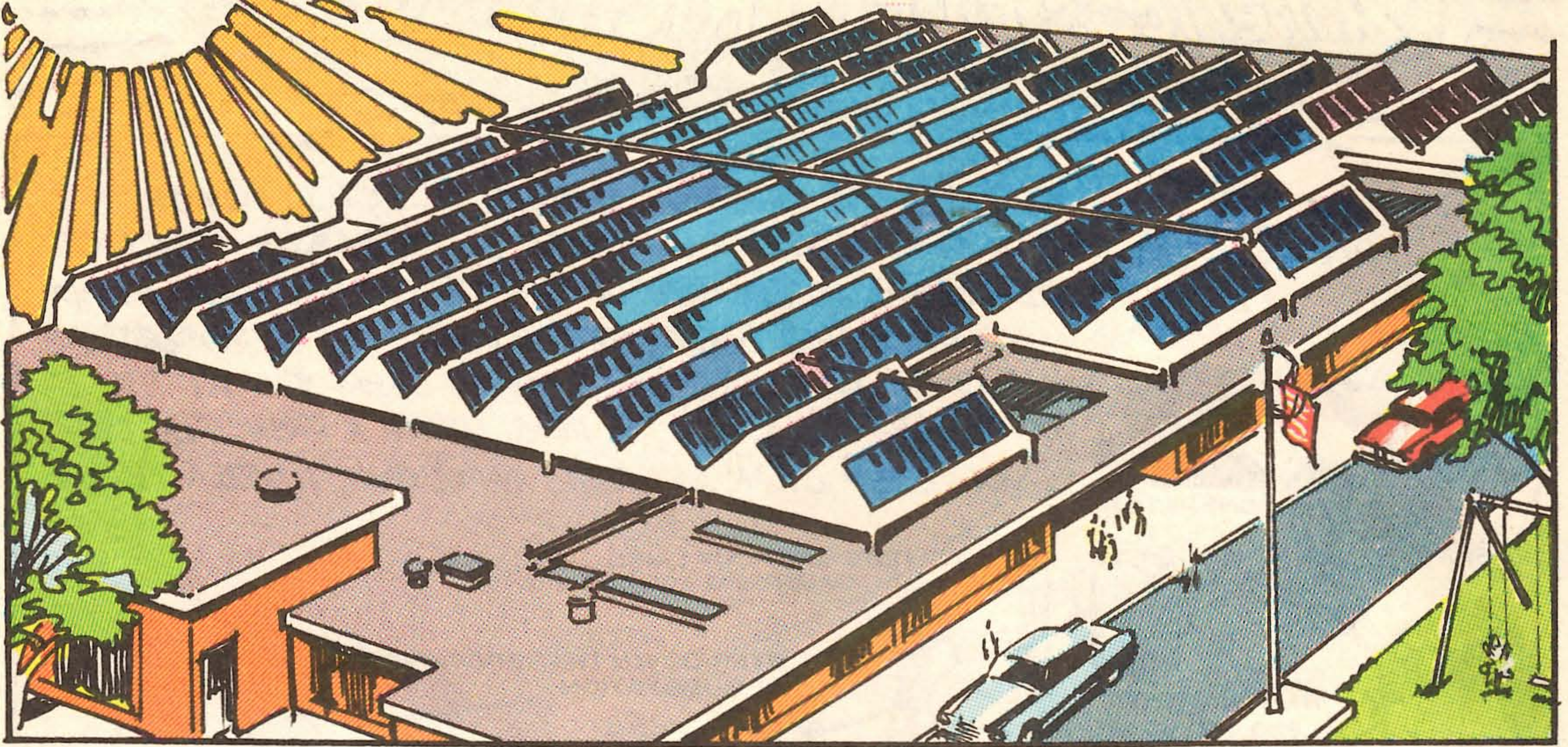
PULSATING WITH ALTERNATING-CURRENT ELECTRICITY CRISSCROSS AMERICA, FROM RURAL COMMUNITIES TO THE BIG CITIES, PROVIDING ENERGY FOR "ELECTRIC" LAMPS, HOME APPLIANCES, RADIOS, STEREO HI-FI SETS, TELEVISION, OFFICE MACHINES, MACHINERY AND EQUIPMENT IN BUSINESS AND GOVERNMENT.



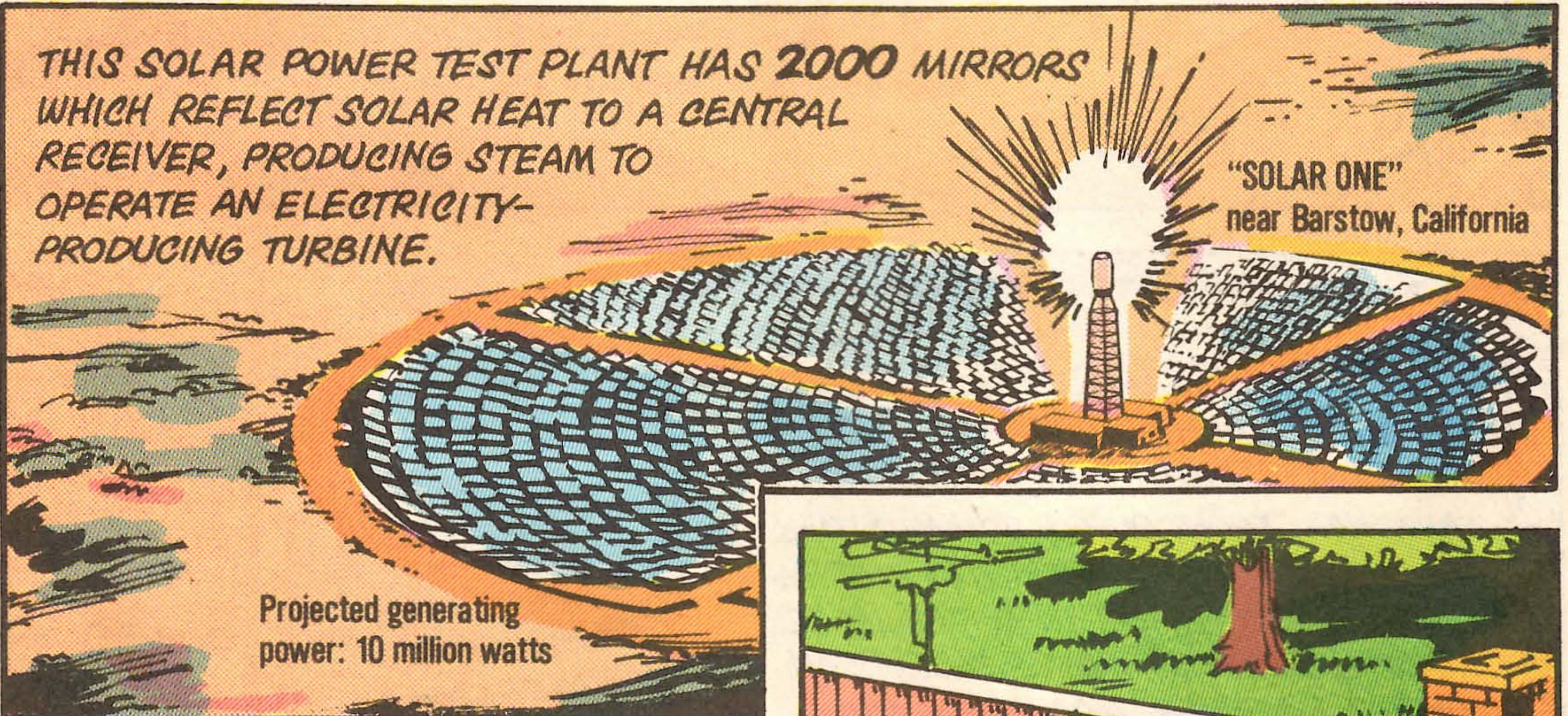
WE MUST CONSERVE ENERGY, BUT WE MUST ALSO CONTINUE TO DEVELOP NEW SOURCES OF ENERGY TO ENSURE OUR COUNTRY'S FUTURE ECONOMIC GROWTH.

SOLAR POWER

ONE OF THE NATION'S LARGEST SOLAR HEATING AND COOLING SYSTEMS HAS BEEN IN OPERATION SINCE 1975 AT THE GEORGE A. TOWNS ELEMENTARY SCHOOL IN ATLANTA, GEORGIA.

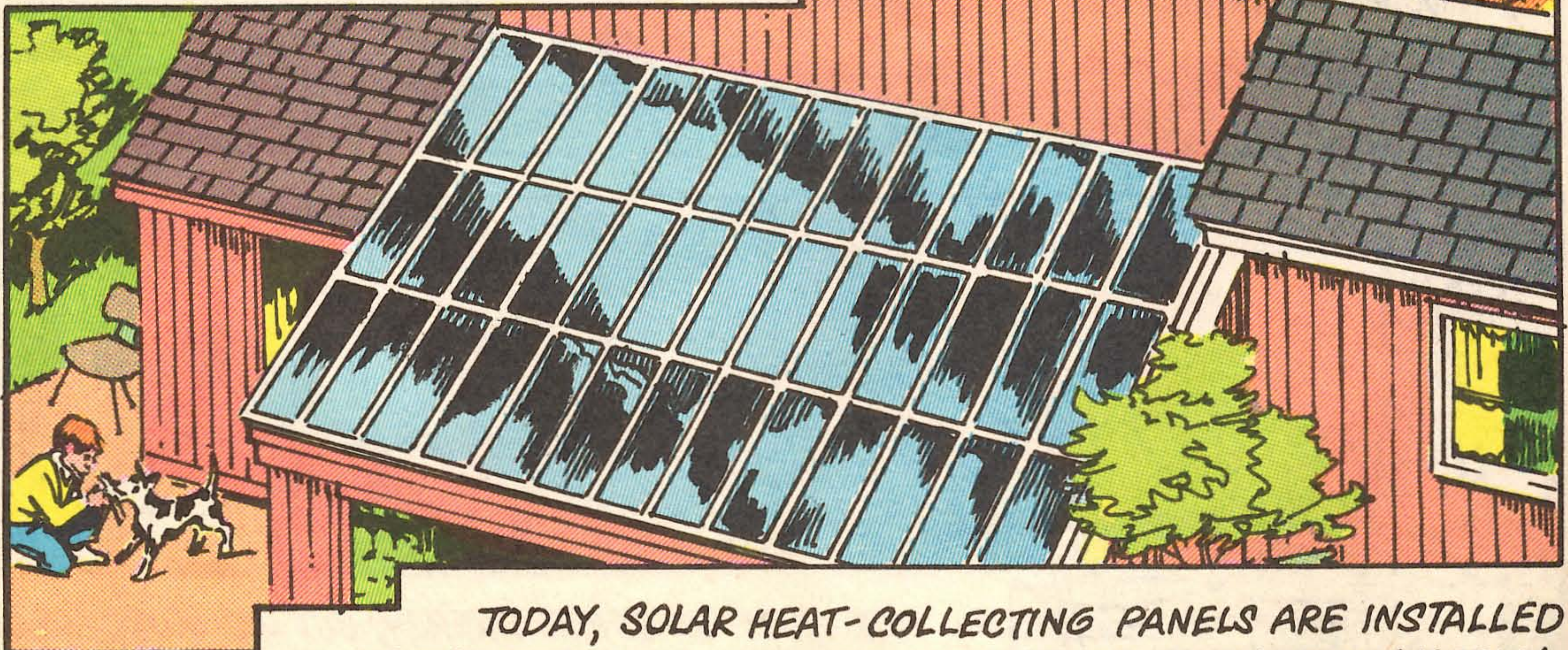


THIS SOLAR POWER TEST PLANT HAS 2000 MIRRORS WHICH REFLECT SOLAR HEAT TO A CENTRAL RECEIVER, PRODUCING STEAM TO OPERATE AN ELECTRICITY-PRODUCING TURBINE.



"SOLAR ONE"
near Barstow, California

Projected generating
power: 10 million watts



TODAY, SOLAR HEAT-COLLECTING PANELS ARE INSTALLED ON THE ROOFS OF MANY NEW HOMES BEING BUILT IN AMERICA. THE SOLAR ENERGY PROVIDES HOT WATER AND HEATING OF THE ROOMS.

SOLAR POWER

EVEN A BEAUTIFUL OLD CHURCH IN NEW ENGLAND IS USING MODERN SOLAR ROOF PANELS TO COLLECT THE WARMTH FROM SUNSHINE AND THEN TRANSFER IT TO A SPACE HEATING SYSTEM AS A MEANS OF ENERGY CONSERVATION.

SOLAR PANELS

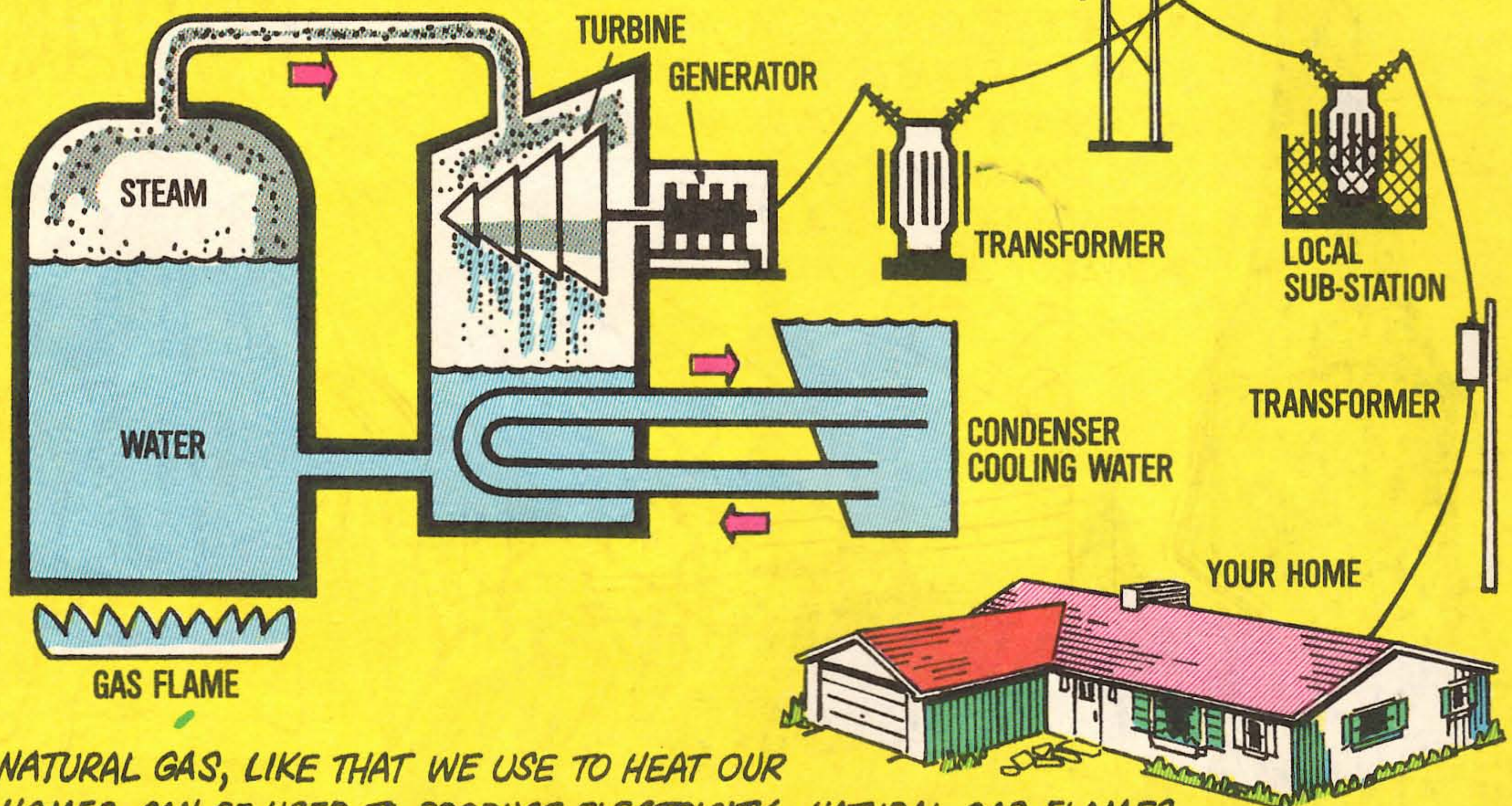
ST. PAUL'S CHURCH
Brookline, Massachusetts

Photovoltaic Power

PHOTOVOLTAIC CELLS

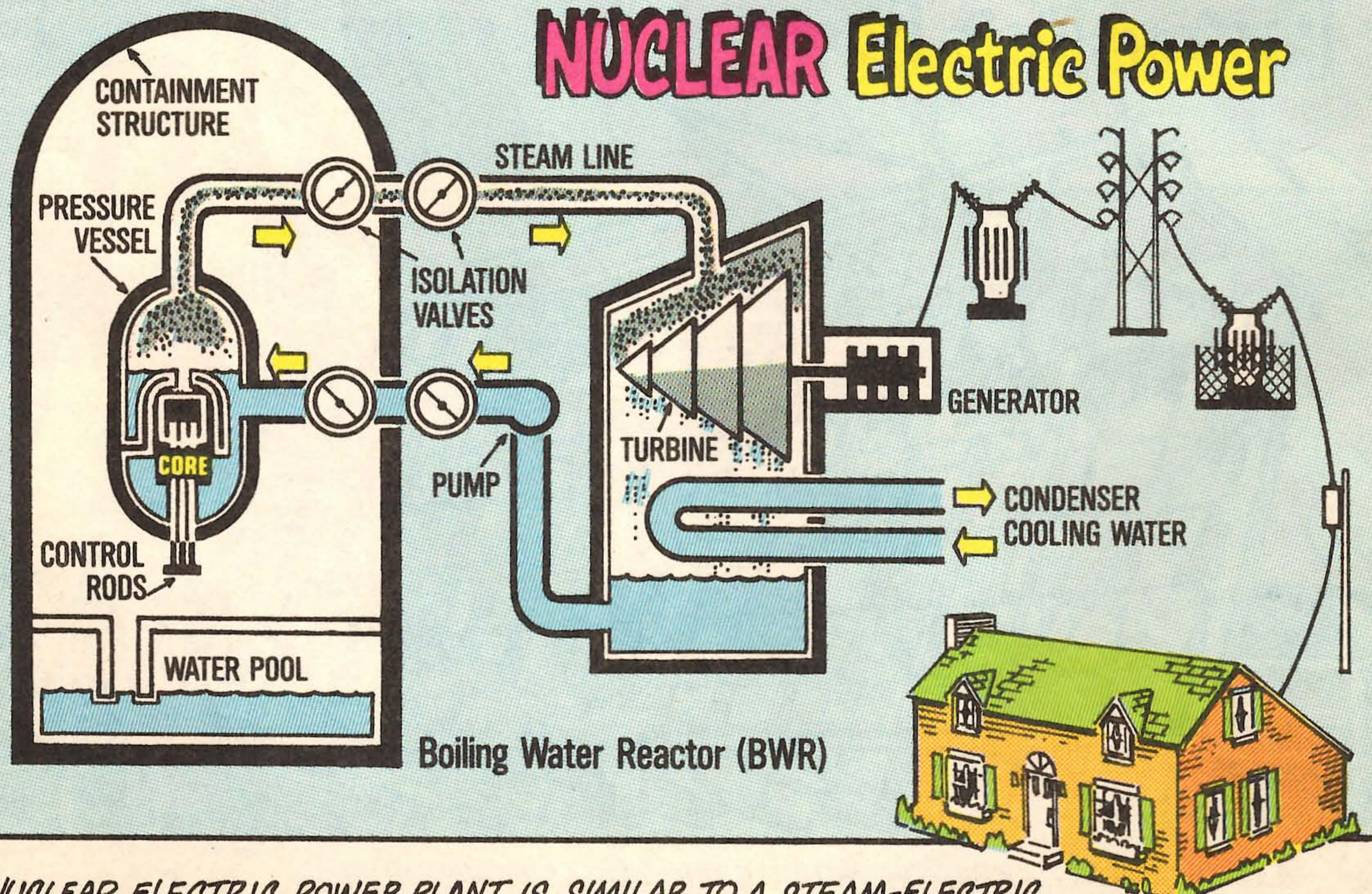
A ONE-KILOWATT ARRAY OF PHOTOVOLTAIC (GALLIUM ARSENIDE) CELLS THAT CONVERT SOLAR ENERGY DIRECTLY INTO ELECTRICITY HAS BEEN BUILT IN CALIFORNIA BY **VARIAN ASSOCIATES** AS PART OF A RESEARCH PROGRAM TO HARNESS THE SUN'S ENERGY.

NATURAL GAS Electric Power



NATURAL GAS, LIKE THAT WE USE TO HEAT OUR HOMES, CAN BE USED TO PRODUCE ELECTRICITY. NATURAL GAS FLAMES HEAT THE WATER IN A BOILER, TURNING IT INTO STEAM WHICH STRIKES THE BLADES OF A TURBINE, CAUSING IT TO ROTATE AN ATTACHED ELECTRICITY GENERATOR. ANOTHER FUEL, COAL, CAN ALSO BE USED TO PRODUCE STEAM.

NUCLEAR Electric Power



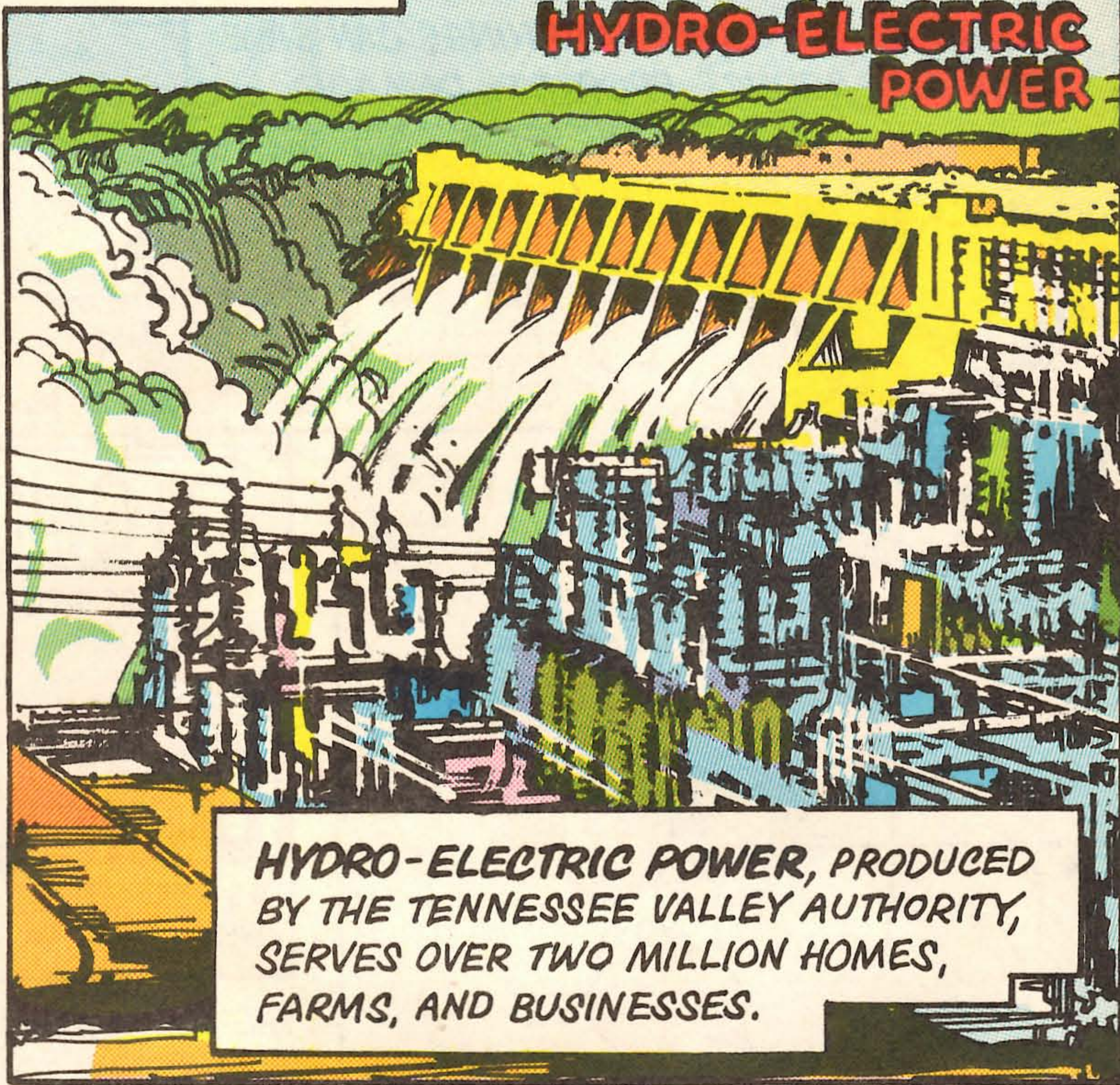
A NUCLEAR ELECTRIC POWER PLANT IS SIMILAR TO A STEAM-ELECTRIC GENERATING SYSTEM, USING COAL OR GAS TO TURN WATER INTO STEAM, WHICH STRIKES THE BLADES OF A TURBINE (WATER WHEEL EFFECT), ROTATING AN ELECTRICITY GENERATOR ATTACHED TO IT. A REACTOR CREATES HEAT FROM FISSIONING (SPLITTING) URANIUM FUEL, WHICH TURNS WATER INTO STEAM TO ROTATE A TURBINE.

GEYSER POWER

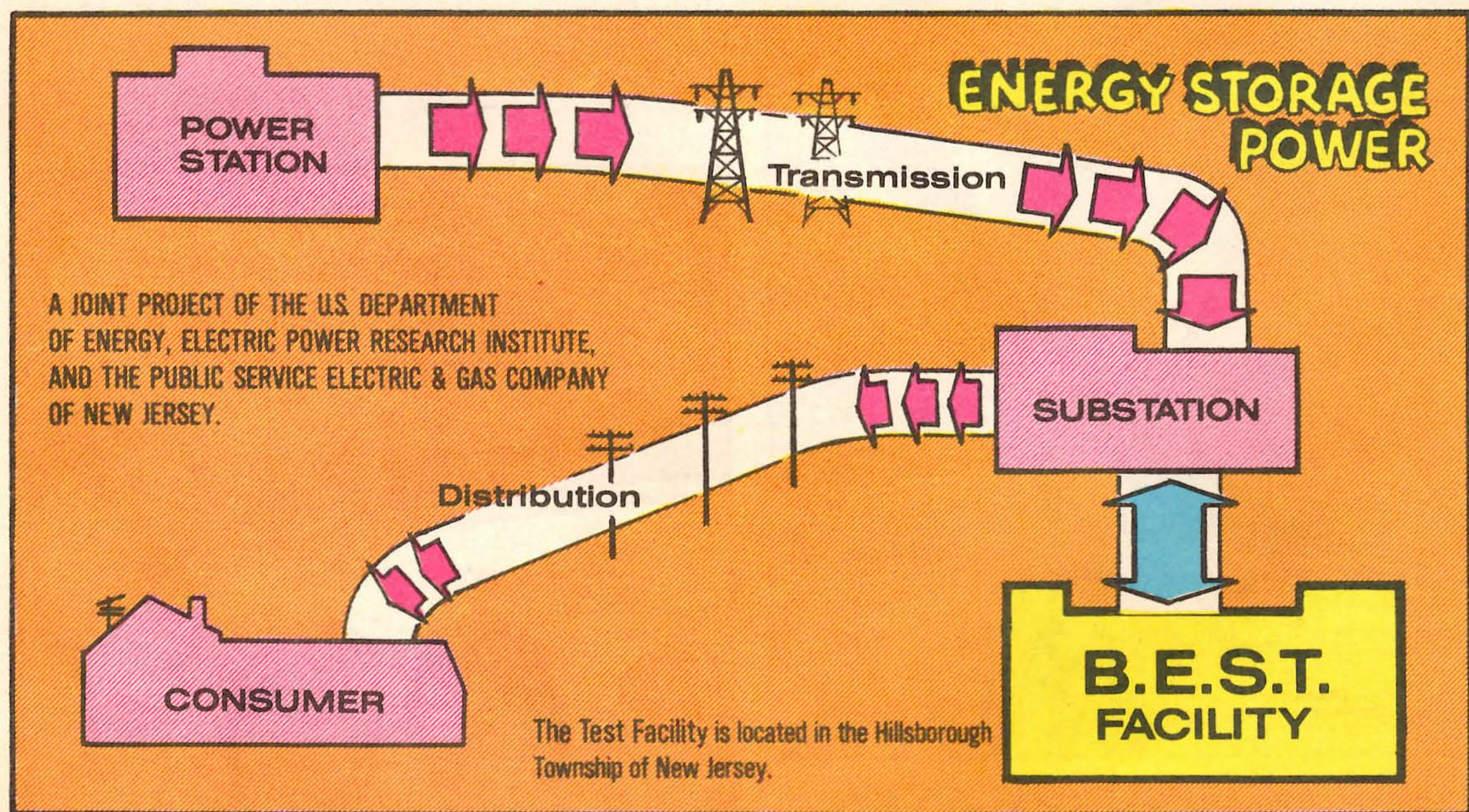
IN CALIFORNIA, PACIFIC GAS & ELECTRIC PIPES THE STEAM FROM **GEYSERS** THROUGH A CLEANSING SYSTEM TO TURBINES THAT GENERATE ELECTRICITY.



HYDRO-ELECTRIC POWER

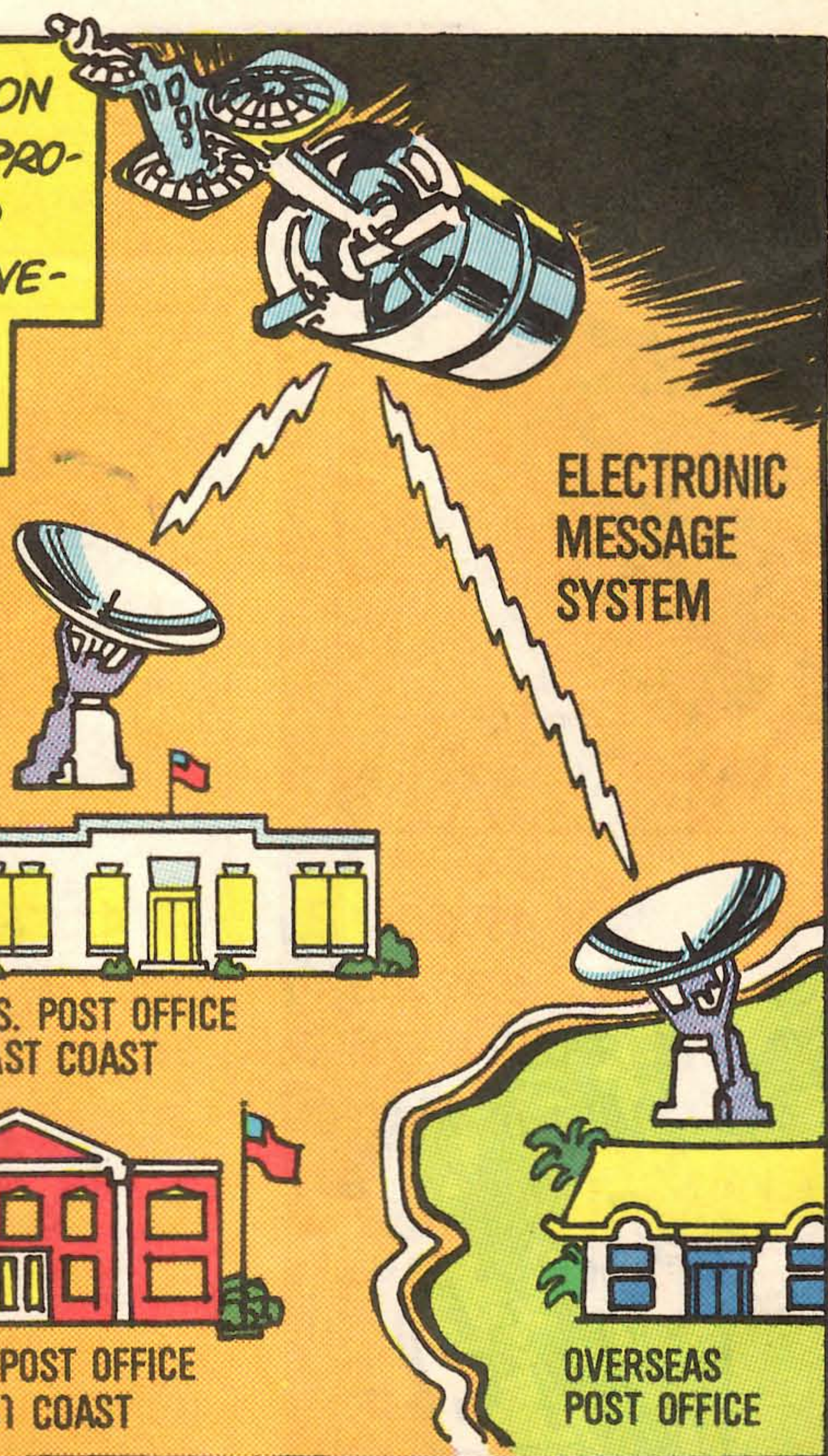
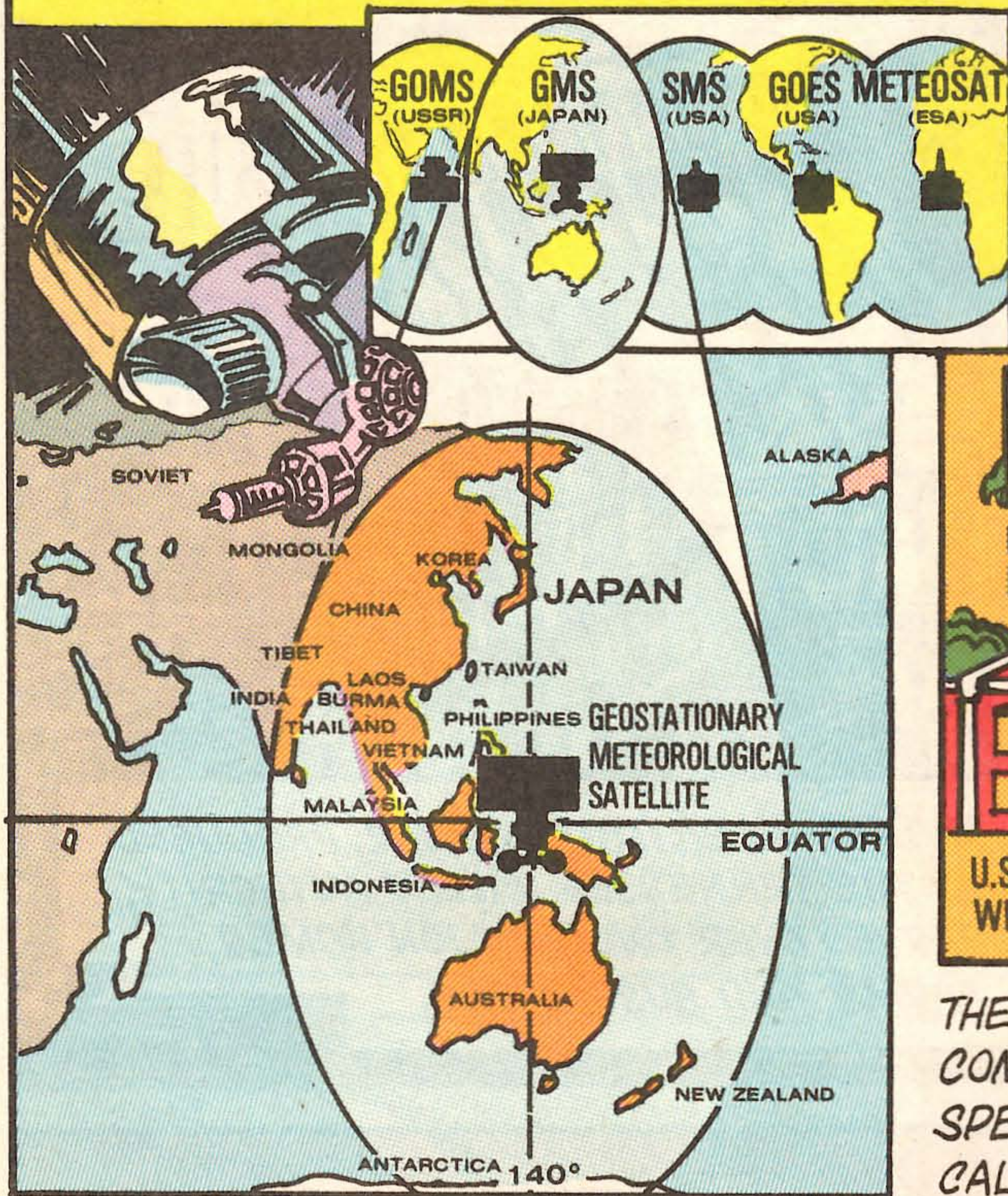


HYDRO-ELECTRIC POWER, PRODUCED BY THE TENNESSEE VALLEY AUTHORITY, SERVES OVER TWO MILLION HOMES, FARMS, AND BUSINESSES.

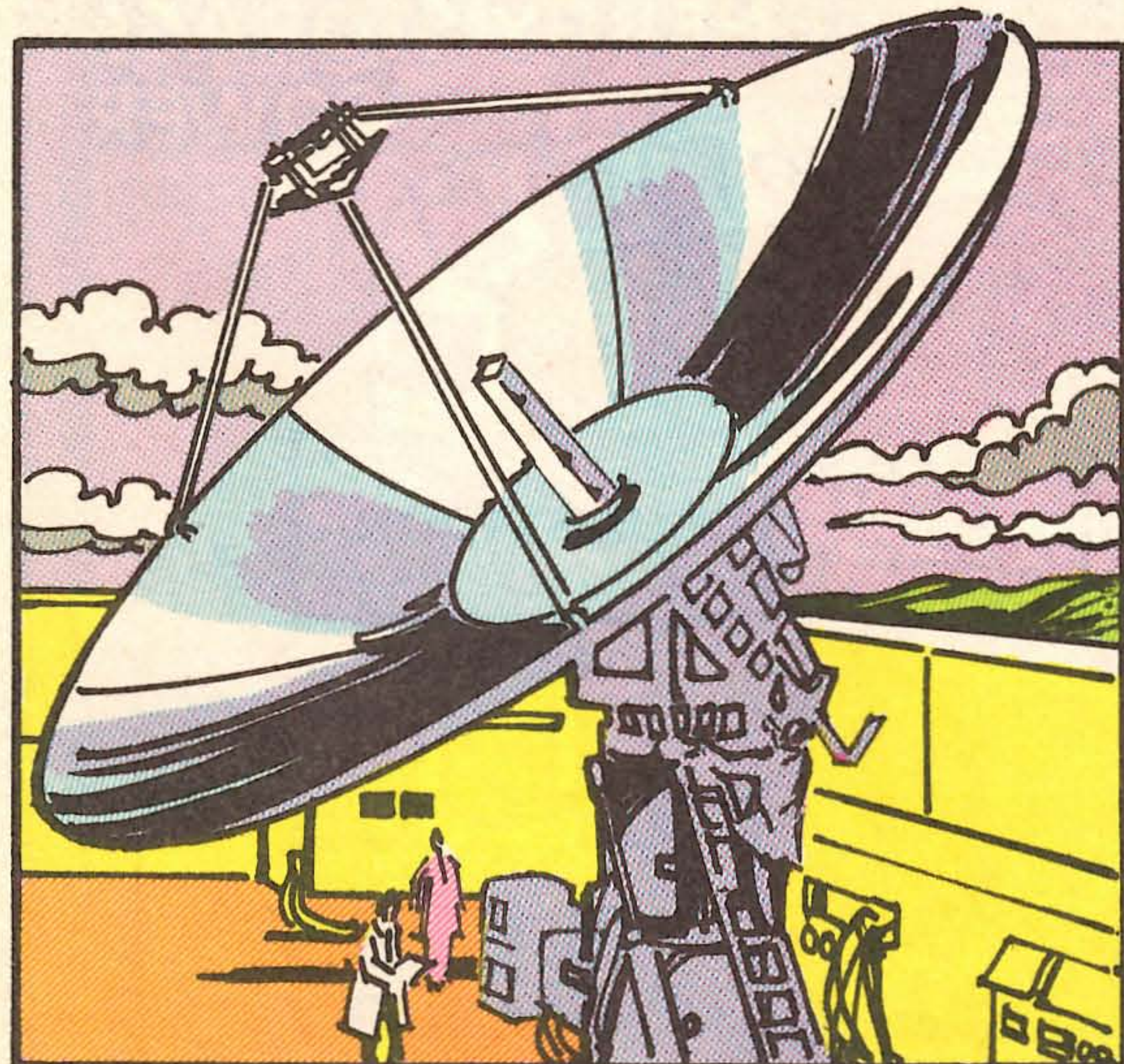


B.E.S.T. (BATTERY ENERGY STORAGE TEST) IS A CLEAN, NON-POLLUTING ELECTRICAL ENERGY STORAGE SYSTEM WHICH STORES ENERGY DURING LOW-DEMAND PERIODS OF THE DAY, AND RELEASES ENERGY DURING PEAK DEMANDS, THEREBY REDUCING THE AMOUNT OF OIL OR OTHER FUEL NEEDED TO RUN THE POWER STATION GENERATORS.

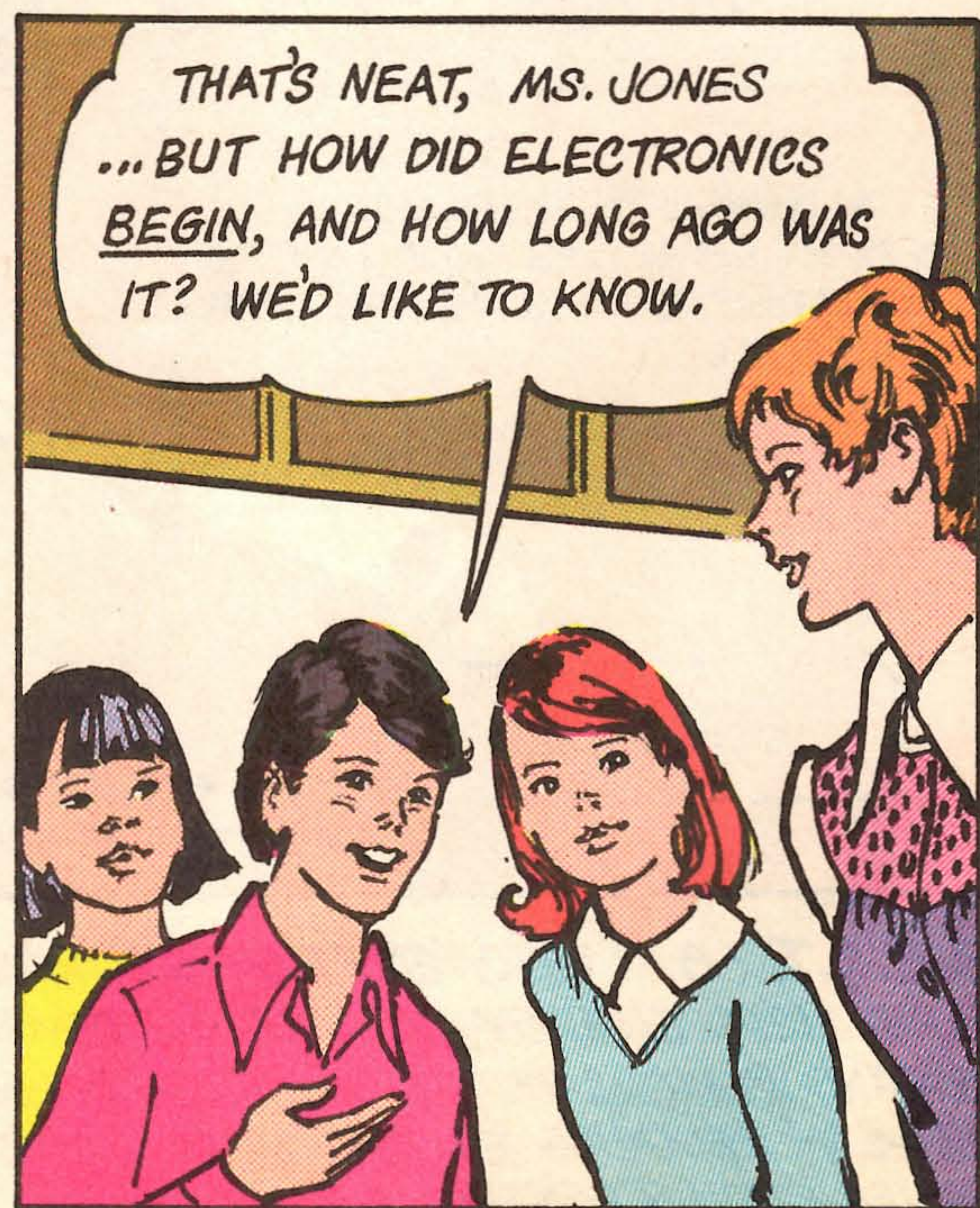
THE WORLD METEOROLOGICAL ORGANIZATION NOW HAS A "WORLD WEATHER WATCH" PROGRAM TO KEEP PEOPLE AROUND THE WORLD INFORMED ABOUT STORM AND WEATHER MOVEMENTS. EARLY STORM WARNINGS CAN SAVE LIVES AND REDUCE PROPERTY DAMAGE.



THE U.S. POSTAL SERVICE IS USING COMPUTERS TO PROMOTE LOW COST AND SPEED FOR MAILINGS. THE SERVICE IS CALLED **E-COM**. THE INTERNATIONAL SERVICE IS CALLED **INTELPOST**.

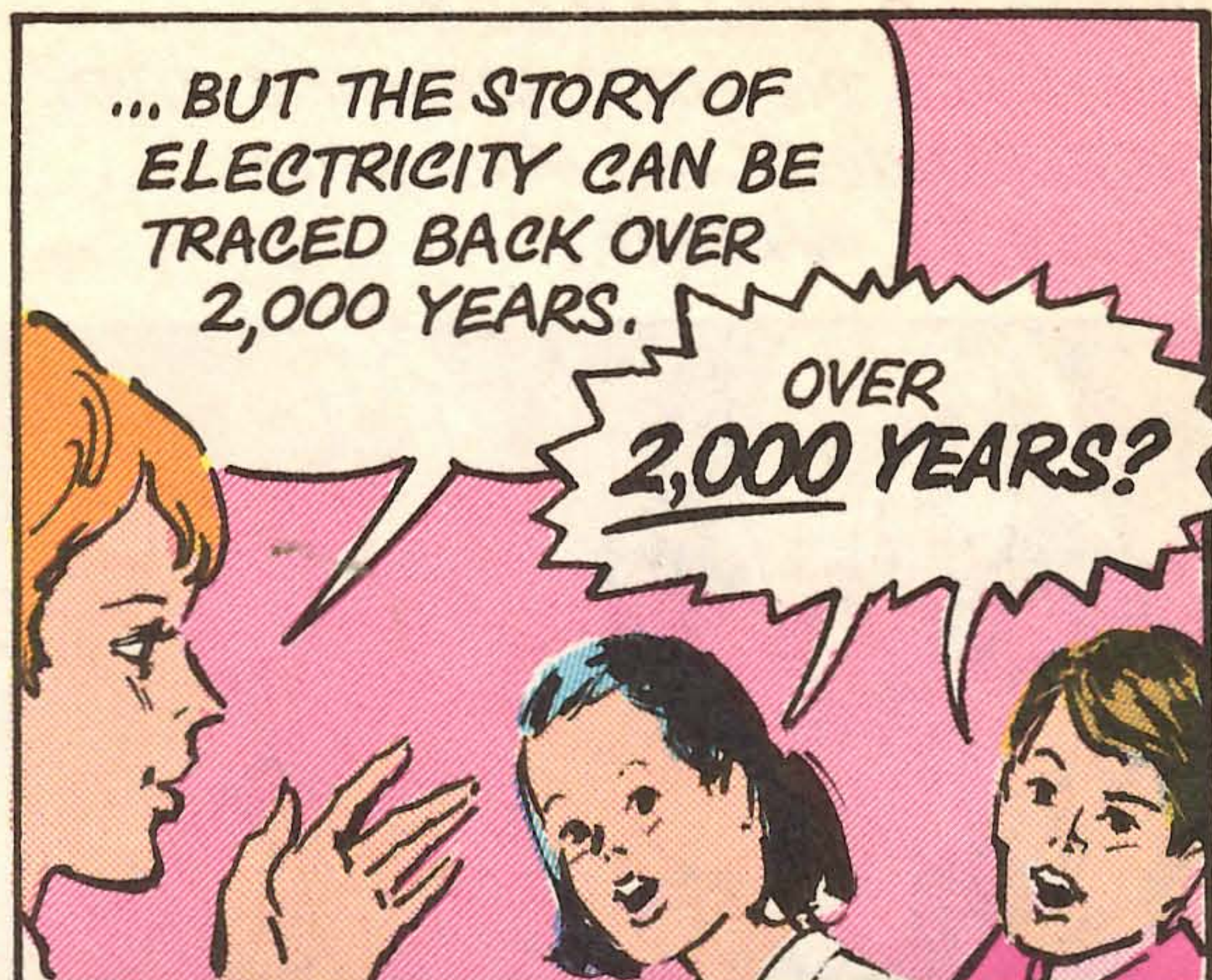
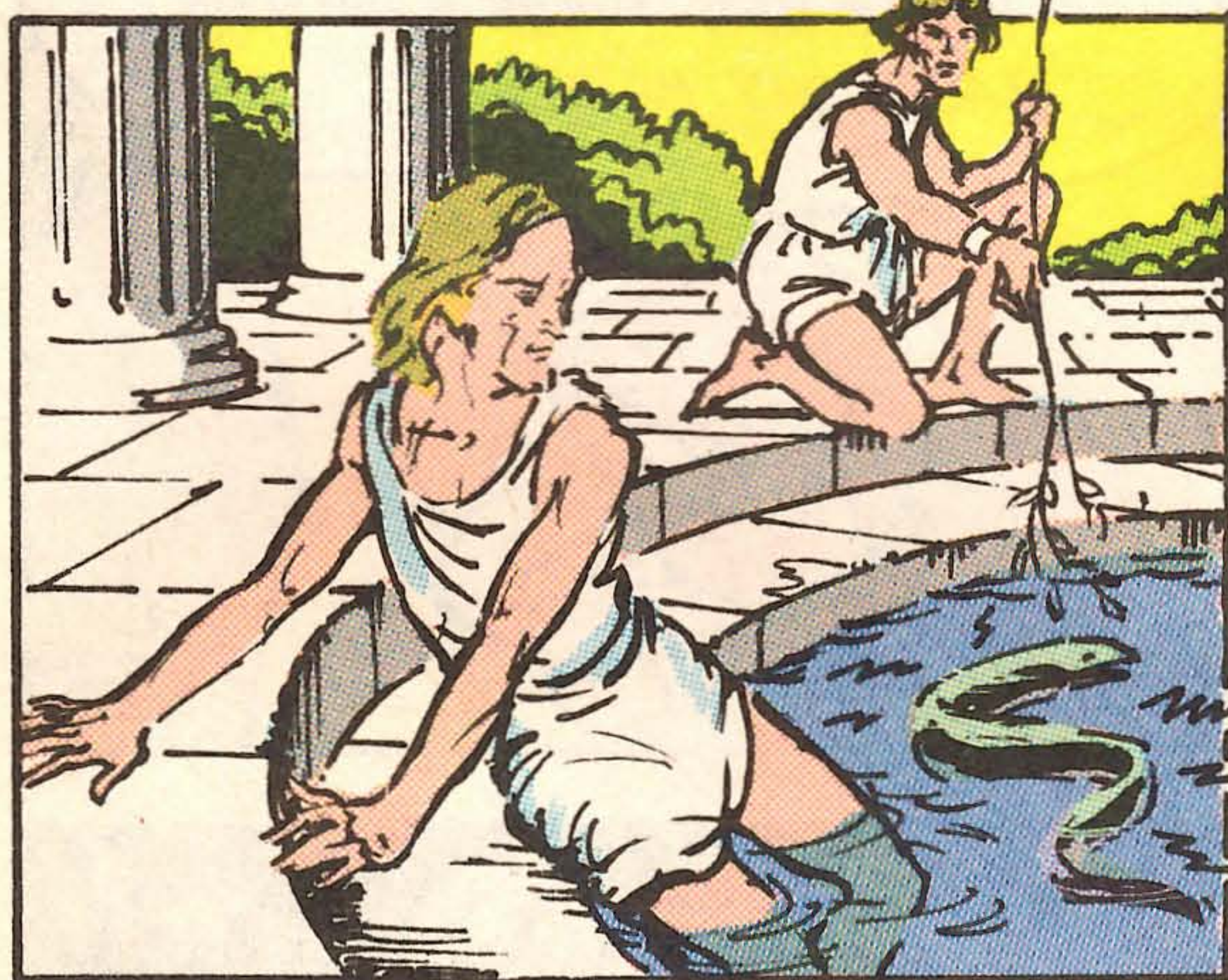


MOBILE SATELLITE GROUND STATIONS SENDING ELECTRONIC SIGNALS TO SATELLITES ABOVE THE EARTH LET US SEE WORLDWIDE EVENTS LIKE THE OLYMPIC GAMES ON COLOR TELEVISION... AND NEWS AND CULTURAL PROGRAMS.





AS EARLY AS 600 B.C., THALES OF MILETUS, GREECE, THEORIZED A CONNECTION BETWEEN ELECTRICITY AND MAGNETISM. THE ANCIENTS EVEN TRIED ELECTRIC SHOCKS FROM EELS AS A TREATMENT FOR RHEUMATIC DISEASES.

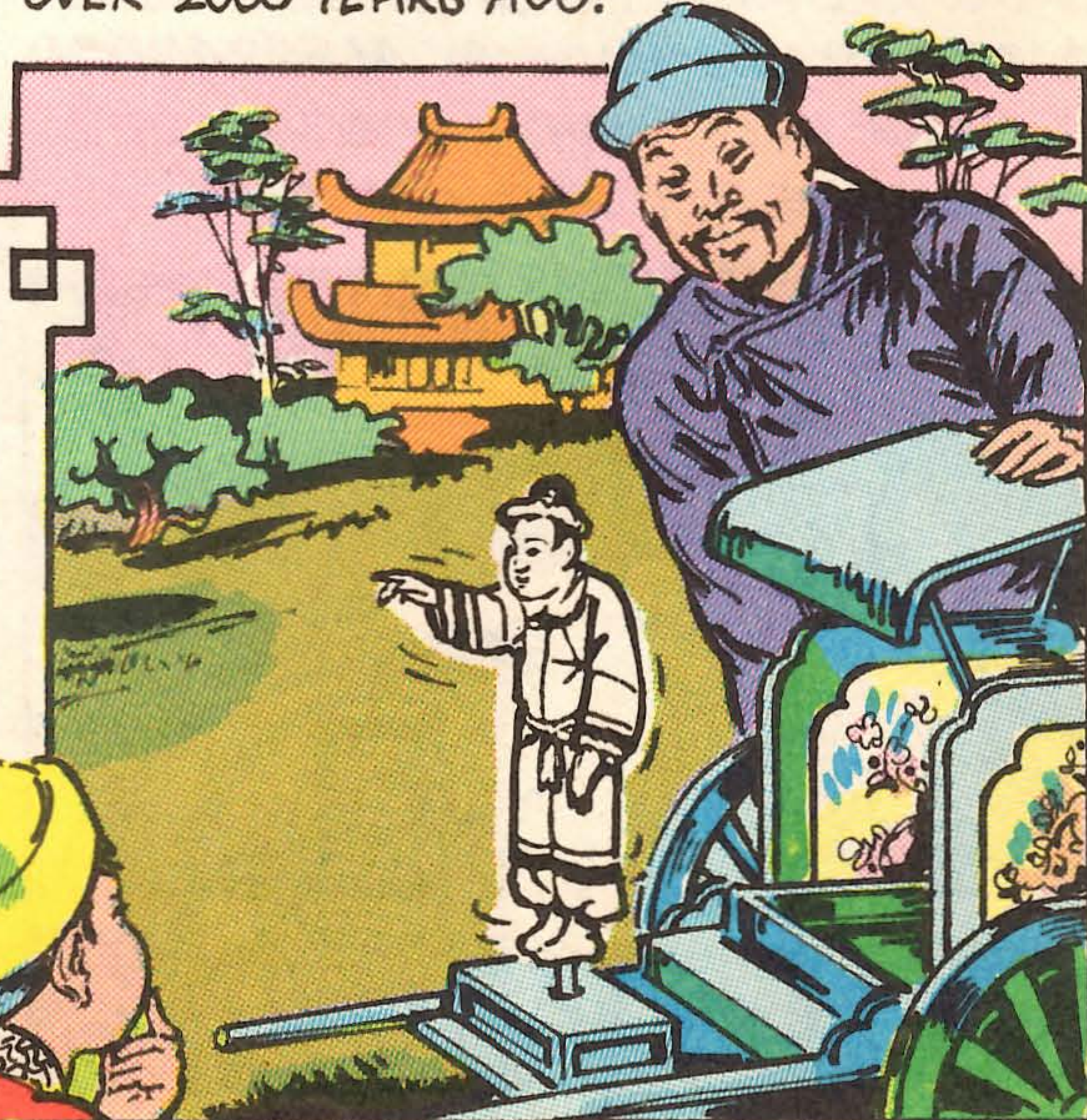


THAT'S RIGHT! AND WHILE WE DON'T KNOW FOR SURE, IT MIGHT HAVE BEGUN LIKE THIS —

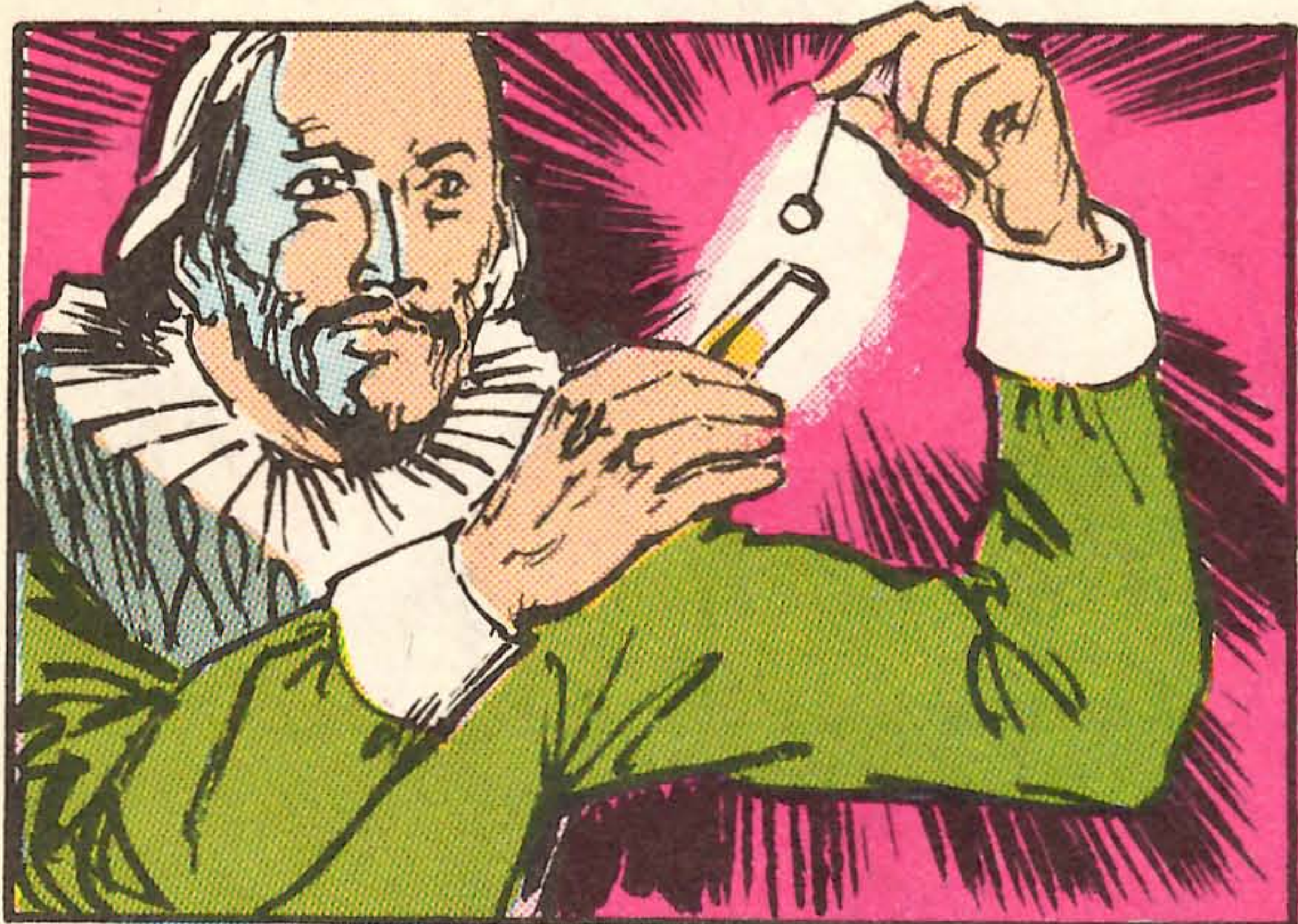


AN ANCIENT "ELECTRIC BATTERY" UNEARTHED IN IRAQ IN 1936 MAY HAVE BEEN USED IN ELECTROPLATING METALS OVER 2000 YEARS AGO.

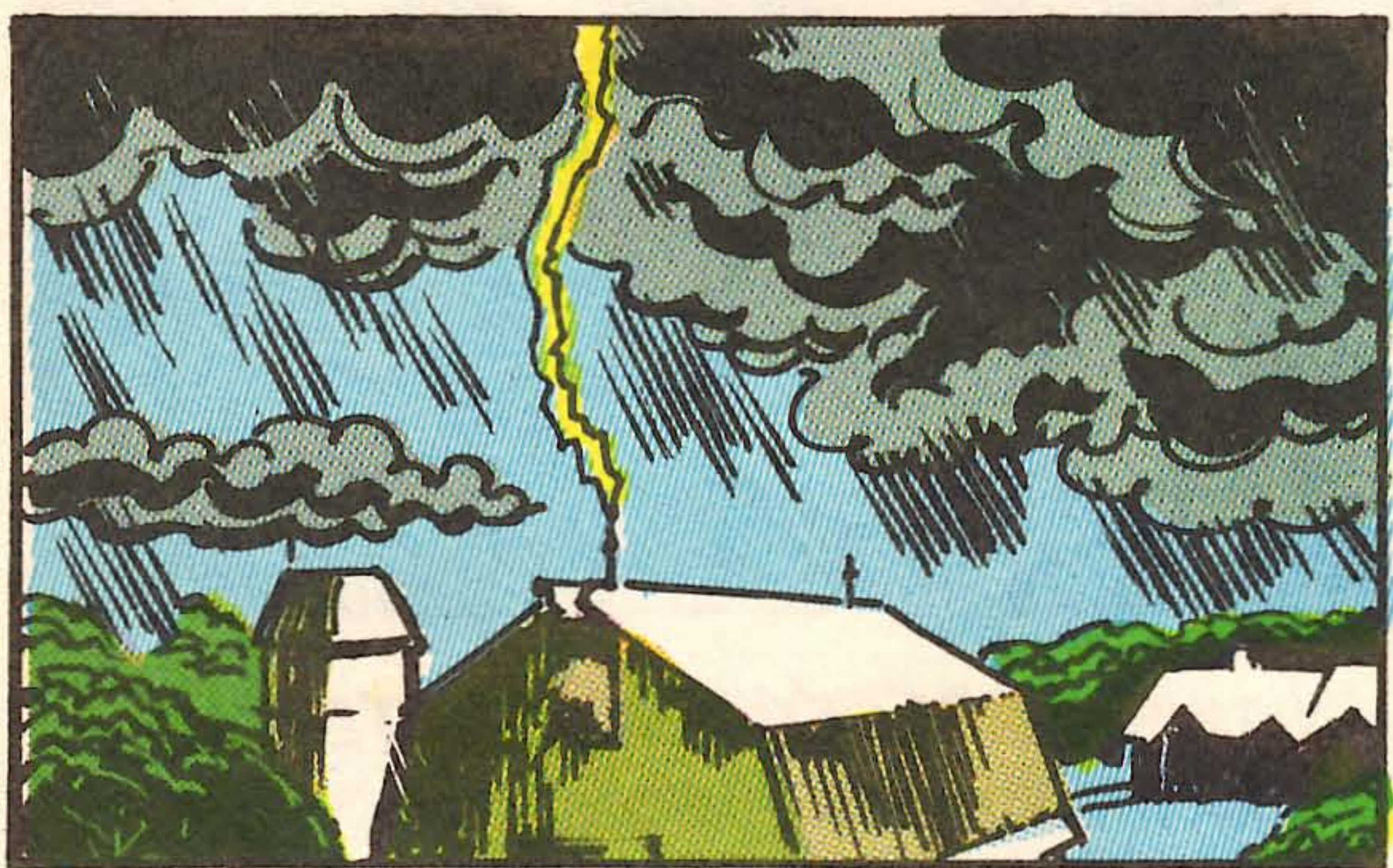
THE GREAT JAPANESE ENCYCLOPEDIA OF 1712 IS SAID TO SHOW A PICTURE OF A "SOUTH POINTING CART" USED IN CHINA IN THE 5TH CENTURY A.D. — A MAGNET IN ITS EXTENDED ARM CAUSED A JADE MANIKIN TO TURN ON A PIVOT — PERHAPS A FORERUNNER OF THE COMPASS USED BY SHIPS.



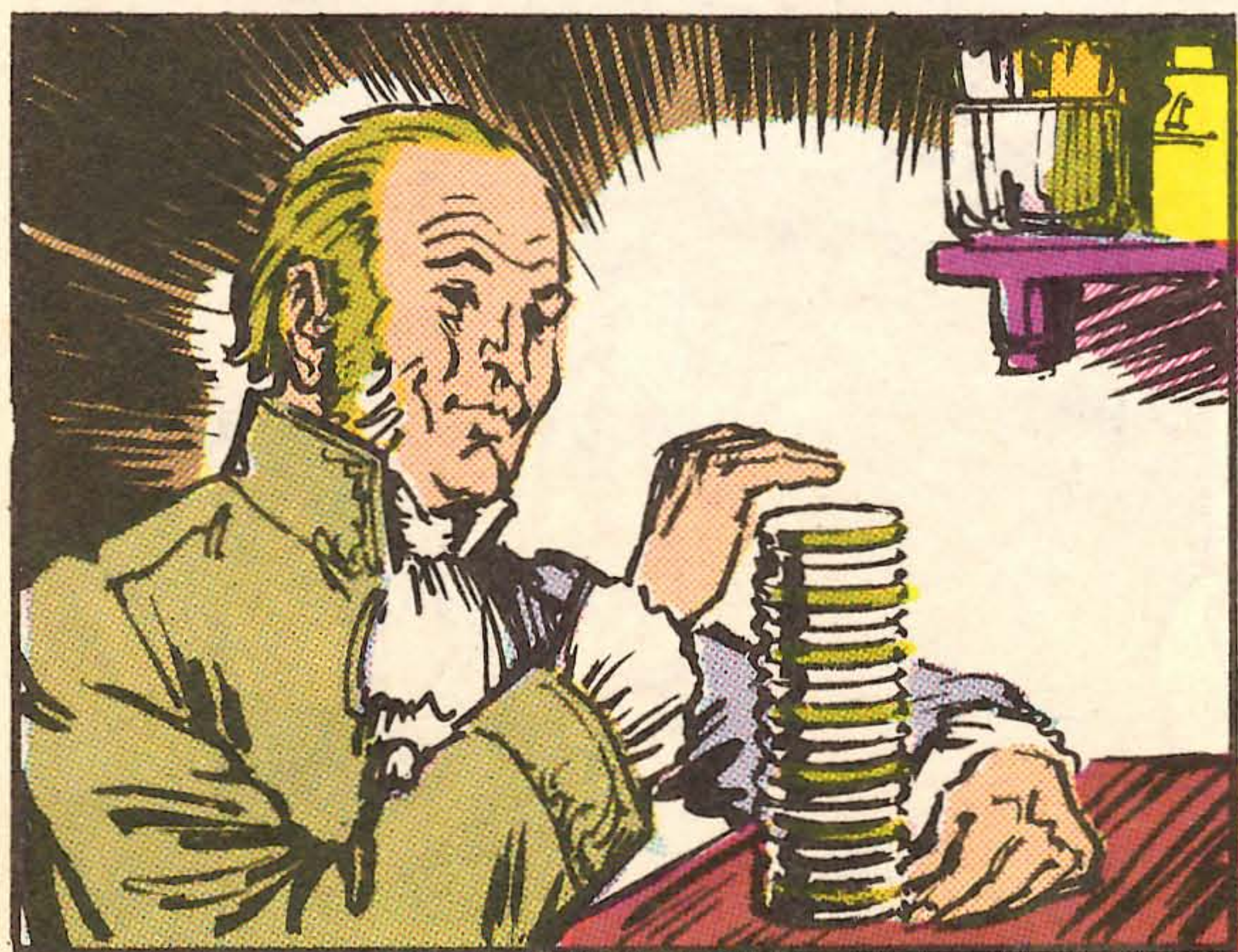
IN 1600 A.D., WILLIAM GILBERT PUBLISHED THE FIRST SCIENTIFIC STUDY OF ELECTRICITY AND MAGNETISM, CALLED "DE MAGNETE".



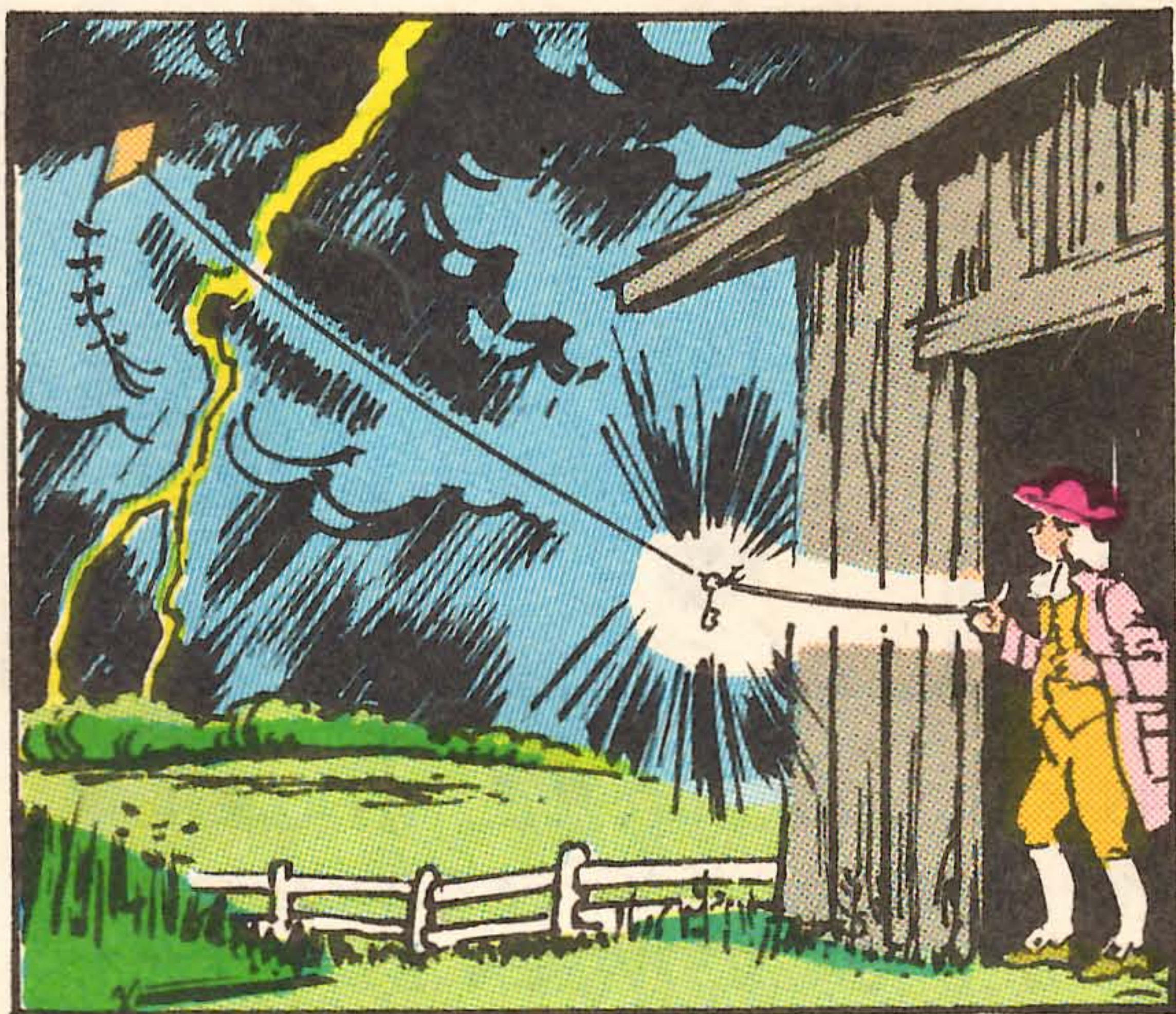
HE LEARNED IT WAS, AND THEN DEvised HIS LIGHTNING ROD SYSTEM TO GROUND DAMAGING ELECTRIC CHARGES — USED TO PROTECT HOMES AND OTHER BUILDINGS TO THIS DAY.



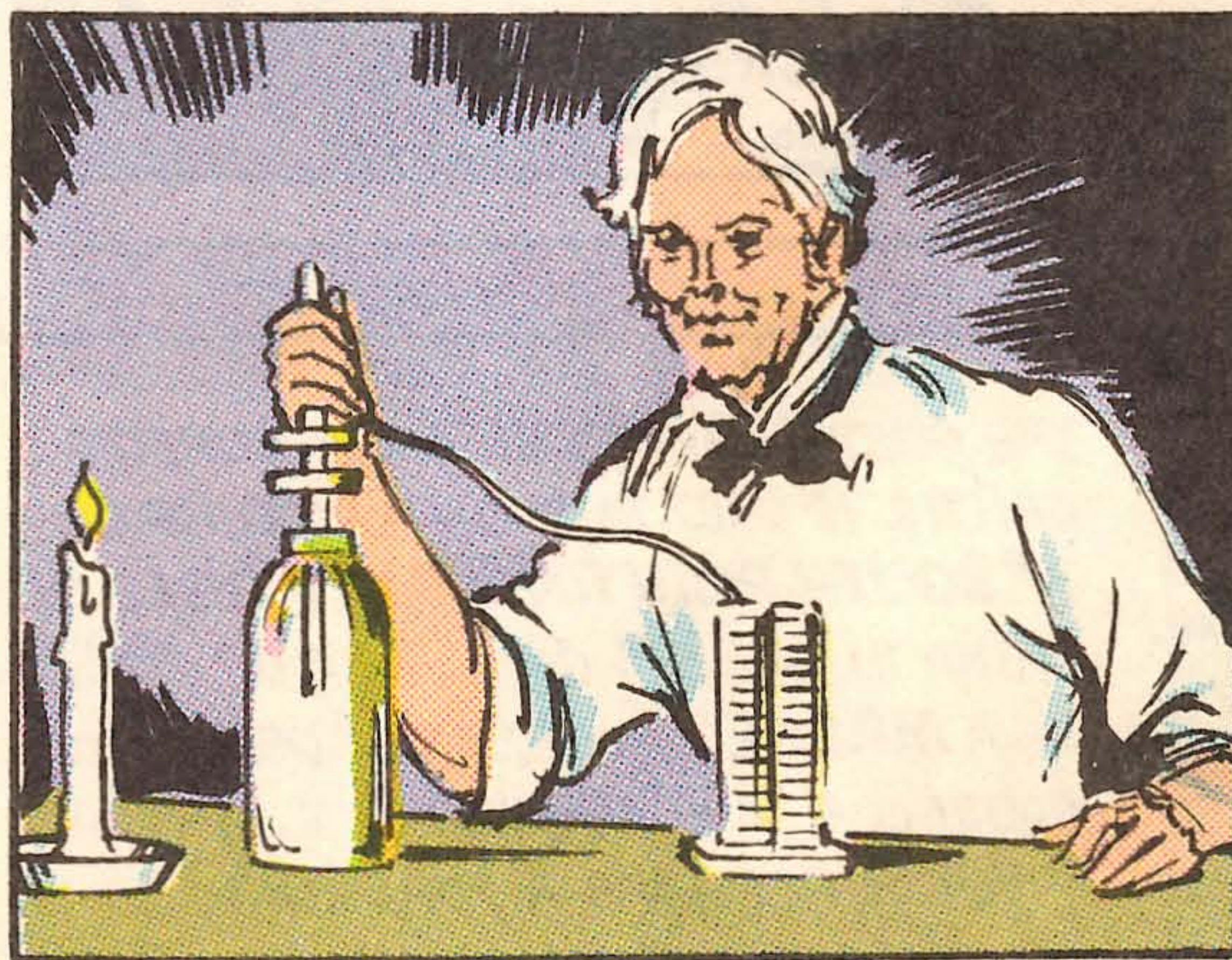
ONE OF THE FIRST PRACTICAL DESIGNS FOR BATTERIES WAS MADE BY ALESSANDRO VOLTA OF ITALY. MANY IMPROVEMENTS WERE MADE BY OTHER INVENTORS.



IN AMERICA, BENJAMIN FRANKLIN SET OUT TO DISCOVER IF NATURAL LIGHTNING WAS THE SAME STUFF AS ELECTRICITY IN HIS FAMOUS KITE AND WIRE EXPERIMENT!

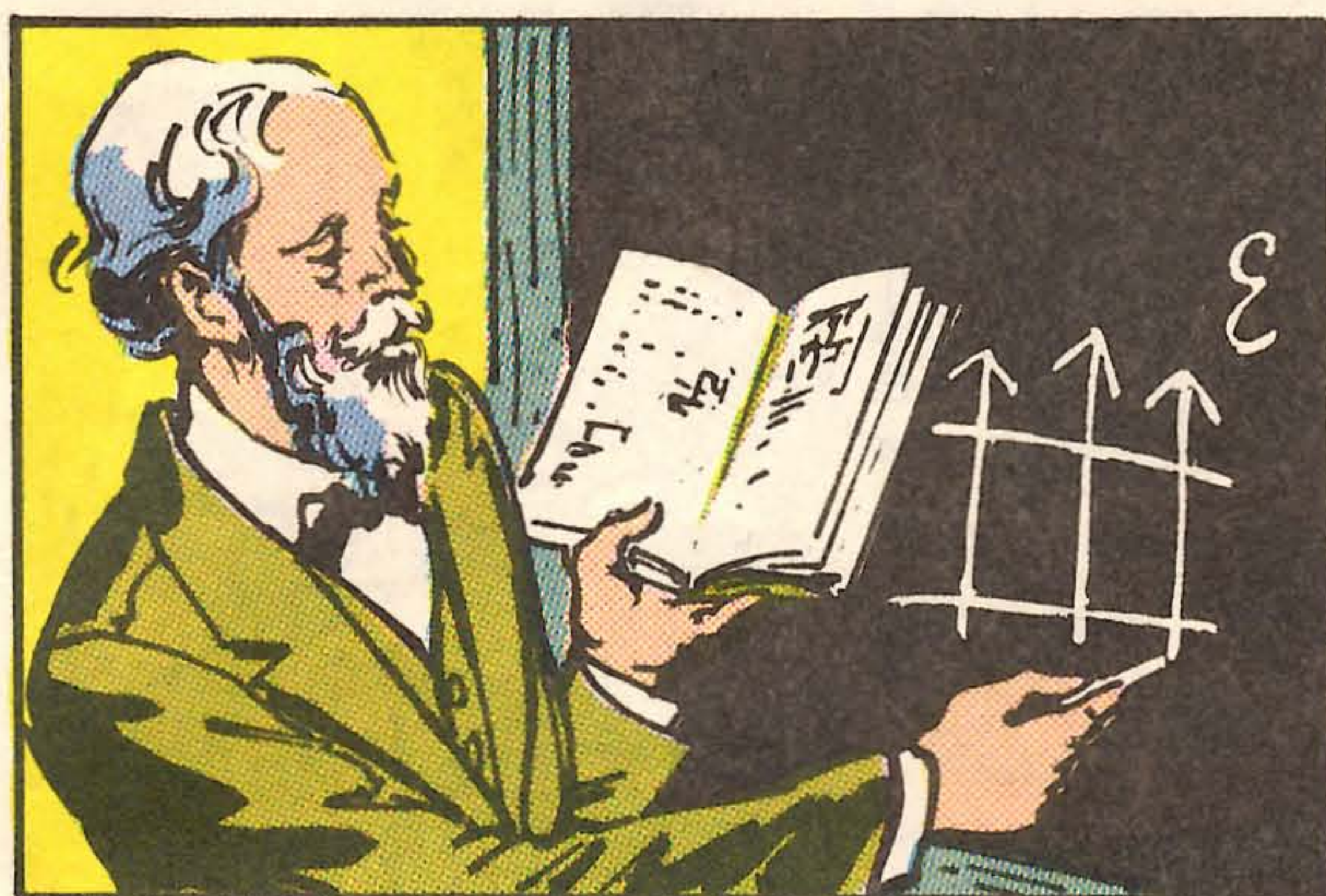


FRANKLIN ALSO ORIGINATED THE "PLUS" AND "MINUS" SIGNS WE USE TO INDICATE ELECTRICAL POLARITY. — YOU'LL SEE THESE SIGNS ON FLASHLIGHT BATTERIES.

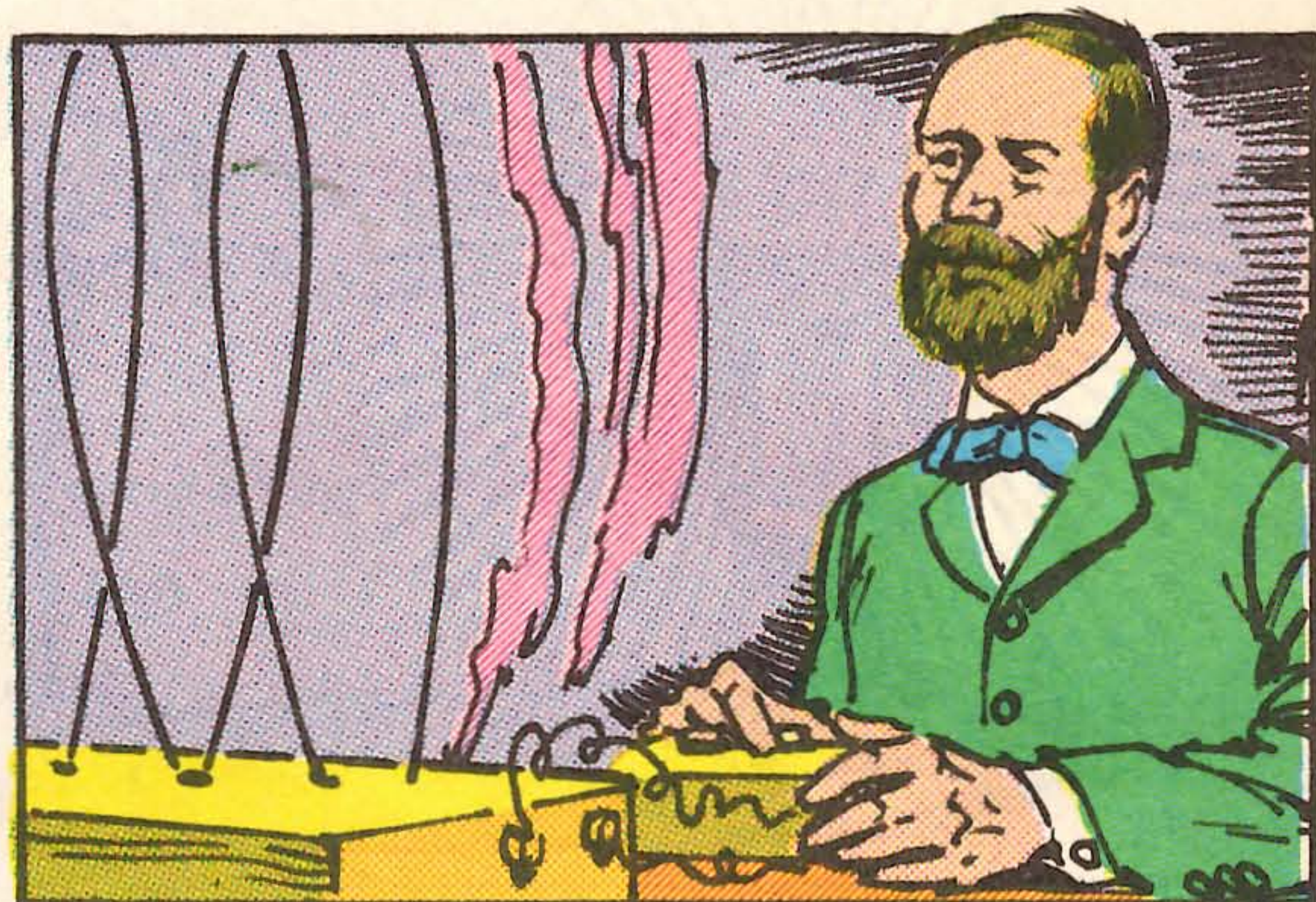


LATER, MICHAEL FARADAY, OF ENGLAND, DEVISED THE FIRST MACHINE TO MAKE ELECTRICITY FROM MECHANICAL ENERGY. IT WASN'T VERY EFFICIENT... BUT IT WORKED!

CLERK MAXWELL, OF ENGLAND, WAS ALSO STUDYING THE WORKS OF FARADAY, DAVY, AND OTHERS. HE PREDICTED WITH MATHEMATICS "ELECTROMAGNETIC DISTURBANCES" IN SPACE.

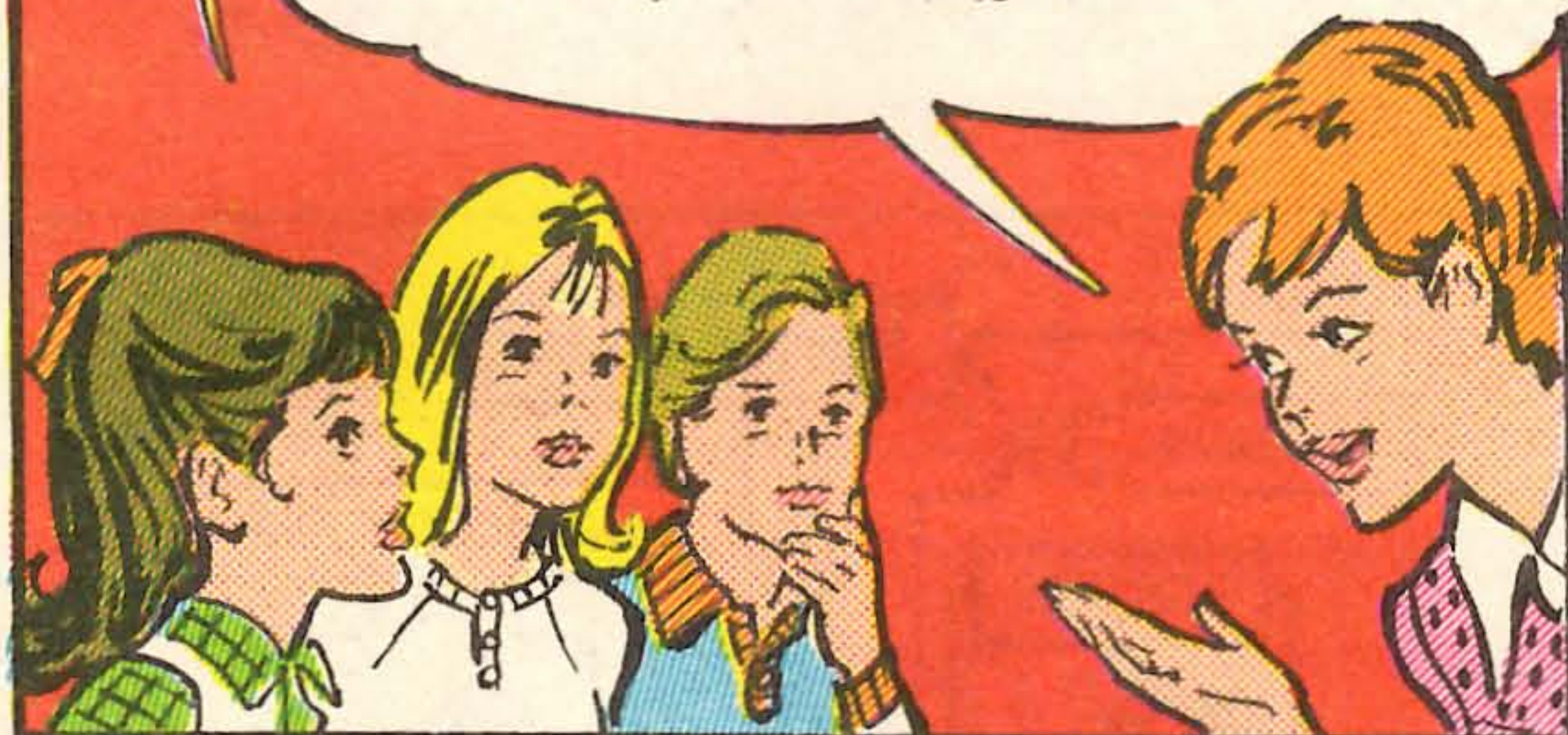


...HEINRICH HERTZ FOUND A WAY TO CREATE THE "DISTURBANCES" STUDIED BY MAXWELL, AND SHOWED THEY BEHAVED IN THE SAME WAY AS LIGHT! IT WAS THE BEGINNING OF "WIRELESS" (RADIO).



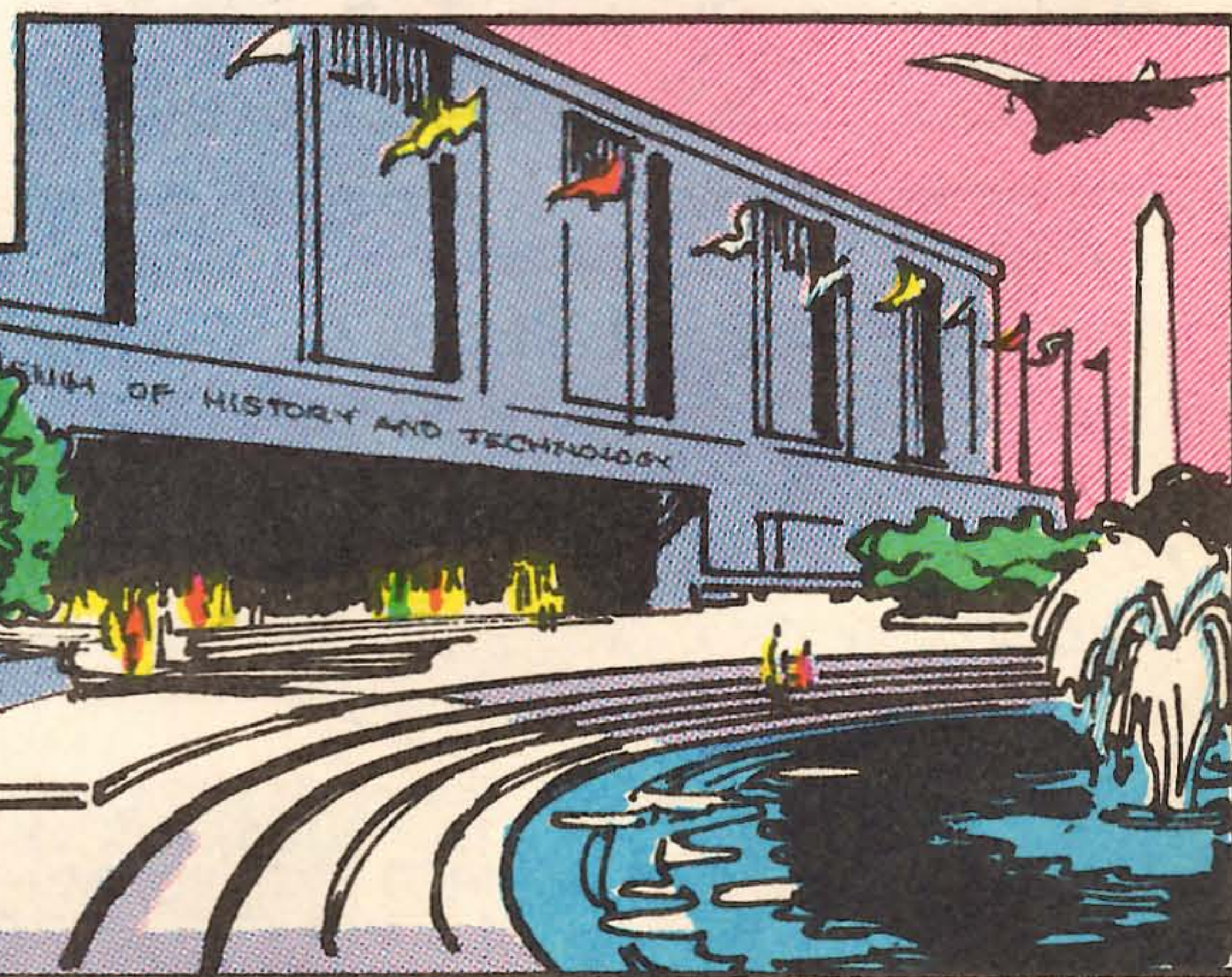
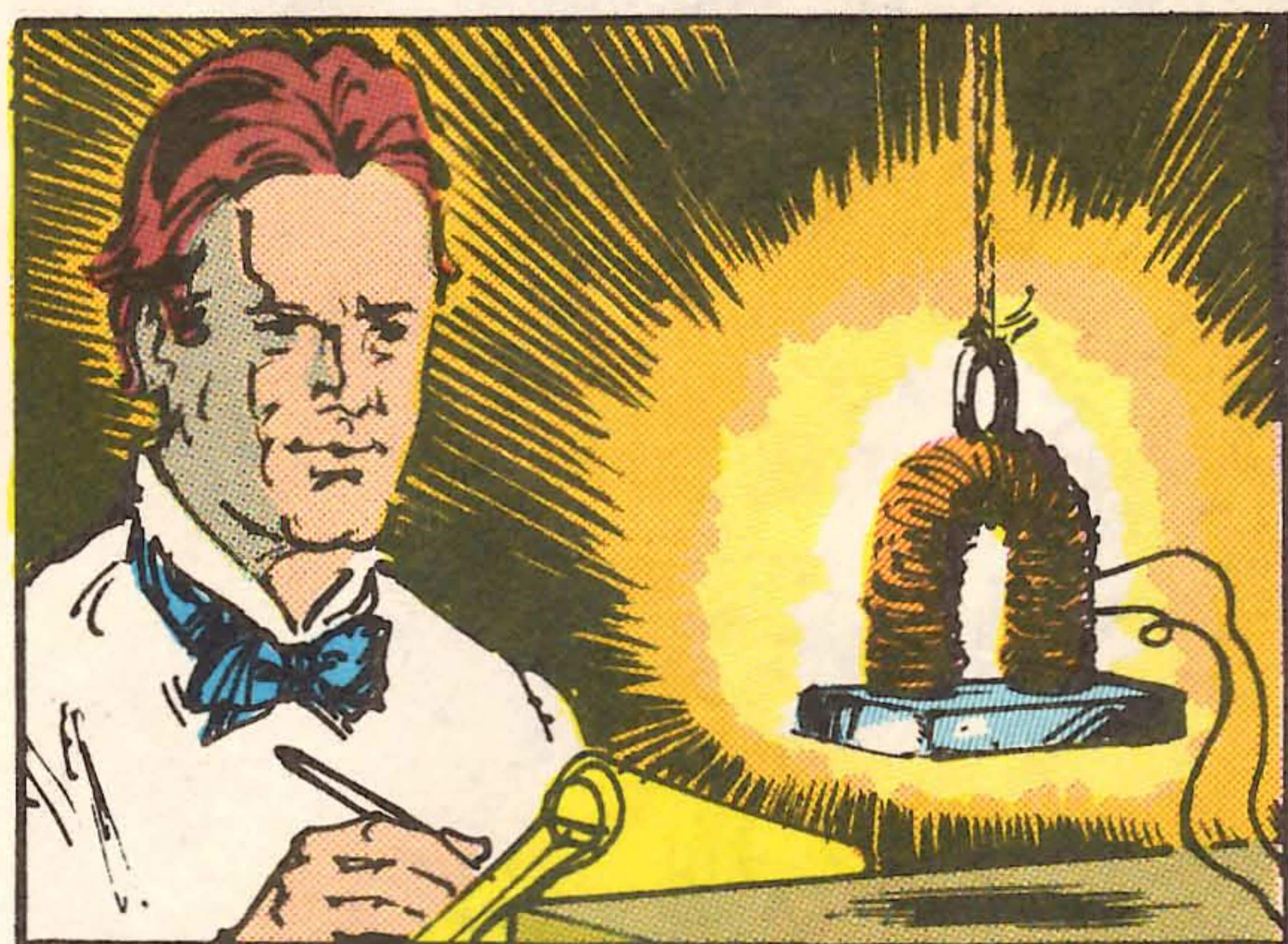
GEE! AN AWFUL LOT OF PEOPLE MUST HAVE STUDIED ELECTRICITY BEFORE ANYBODY COULD ACTUALLY USE IT!

YES, AND MANY OF THEIR NAMES ARE STILL WITH US. FOR EXAMPLE, THE "GILBERT" IS A UNIT OF MAGNETISM...



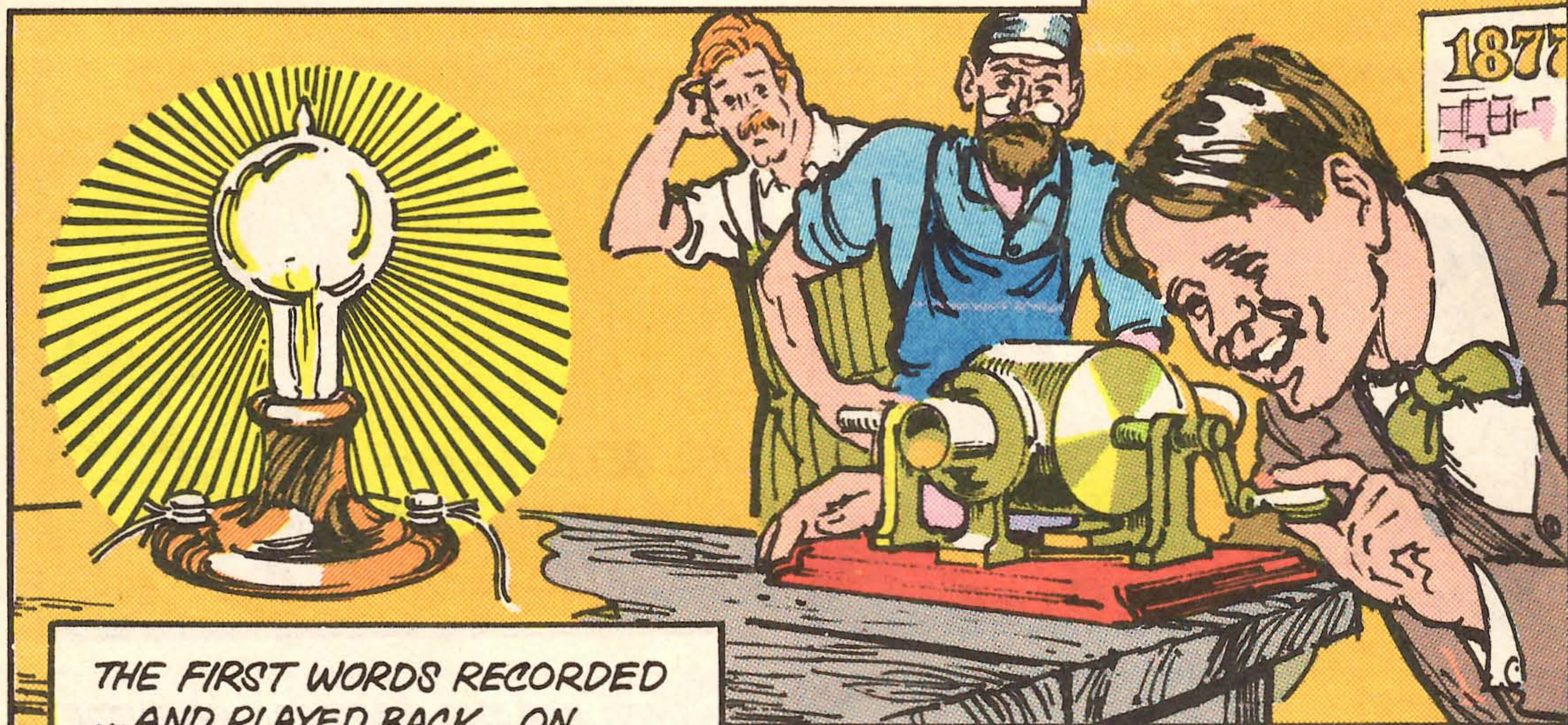
OTHER COMMON ONES ARE: OHM, FARAD, AMPERE, AND HENRY...

...NAMED FOR THE AMERICAN INVENTOR, JOSEPH HENRY, WHO ALSO BUILT THE FIRST ELECTROMAGNET—LATER USED FOR THE DIRECT CURRENT MOTOR.

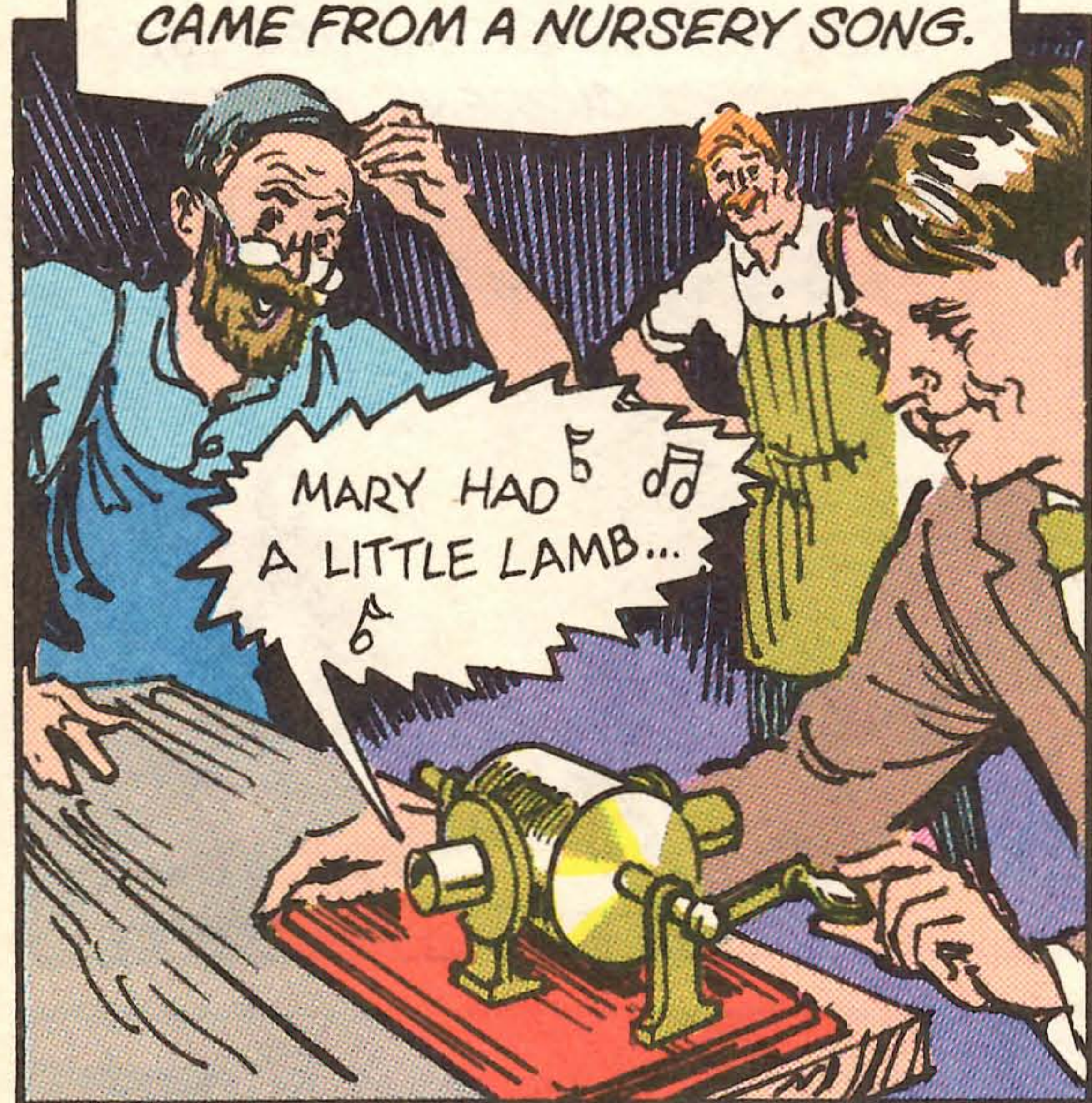


IN 1846, JOSEPH HENRY, INVENTOR AND TEACHER, BECAME THE FIRST SECRETARY OF THE SMITHSONIAN INSTITUTION IN WASHINGTON, D.C., WHICH WAS ESTABLISHED FROM A GIFT TO THE AMERICAN PEOPLE BY JAMES SMITHSON OF SCOTLAND.

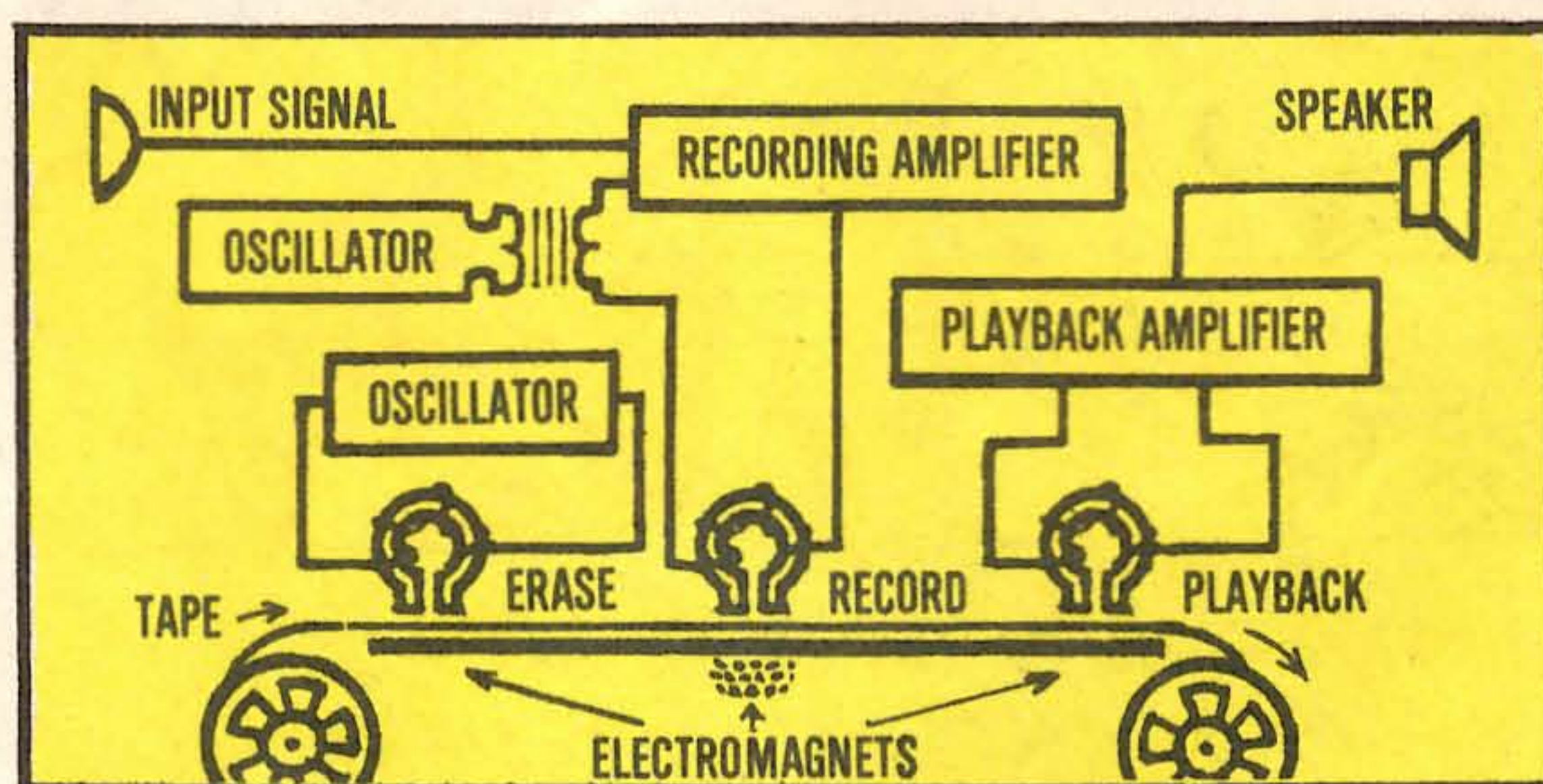
IN ADDITION TO THE ELECTRIC LIGHT BULB, THOMAS ALVA EDISON INVENTED THE PHONOGRAPH IN LATE 1877, FOR SOUND RECORDING AND PLAYBACK — THE FORERUNNER OF TODAY'S DISK RECORDS FOR HI-FI STEREO SYSTEMS.



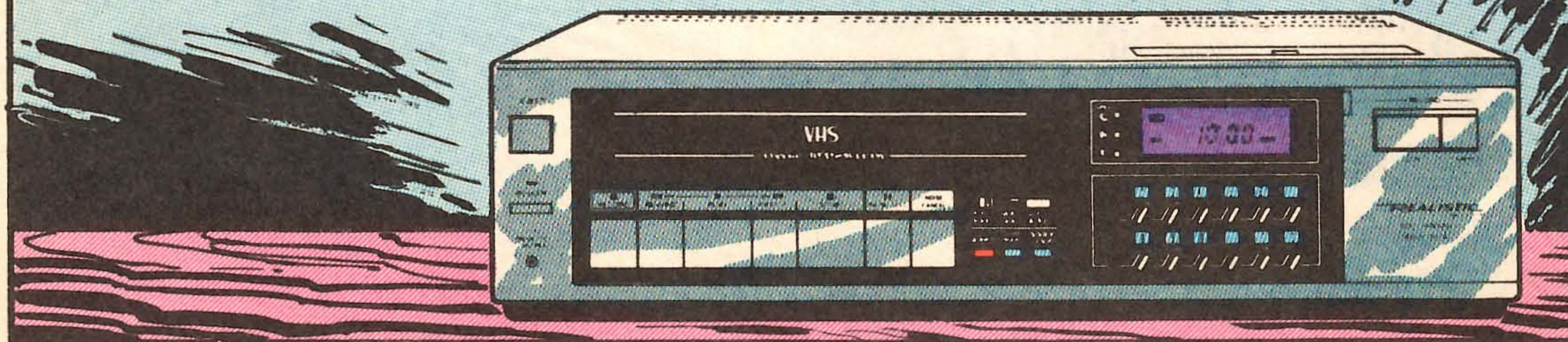
THE FIRST WORDS RECORDED ...AND PLAYED BACK...ON EDISON'S TIN-FOIL RECORD CAME FROM A NURSERY SONG.



IN 1889, A LITTLE MORE THAN A DECADE LATER, VALDEMAR POULSEN INVENTED MAGNETIC RECORDING. TAPE RECORDING WAS INVENTED IN THE LATE 1930'S. THE DIAGRAM BELOW ILLUSTRATES THE PRINCIPLE OF TAPE RECORDING... MANY IMPROVEMENTS ARE FOUND IN THE CASSETTE TAPE RECORDING/PLAYBACK EQUIPMENT OF TODAY.



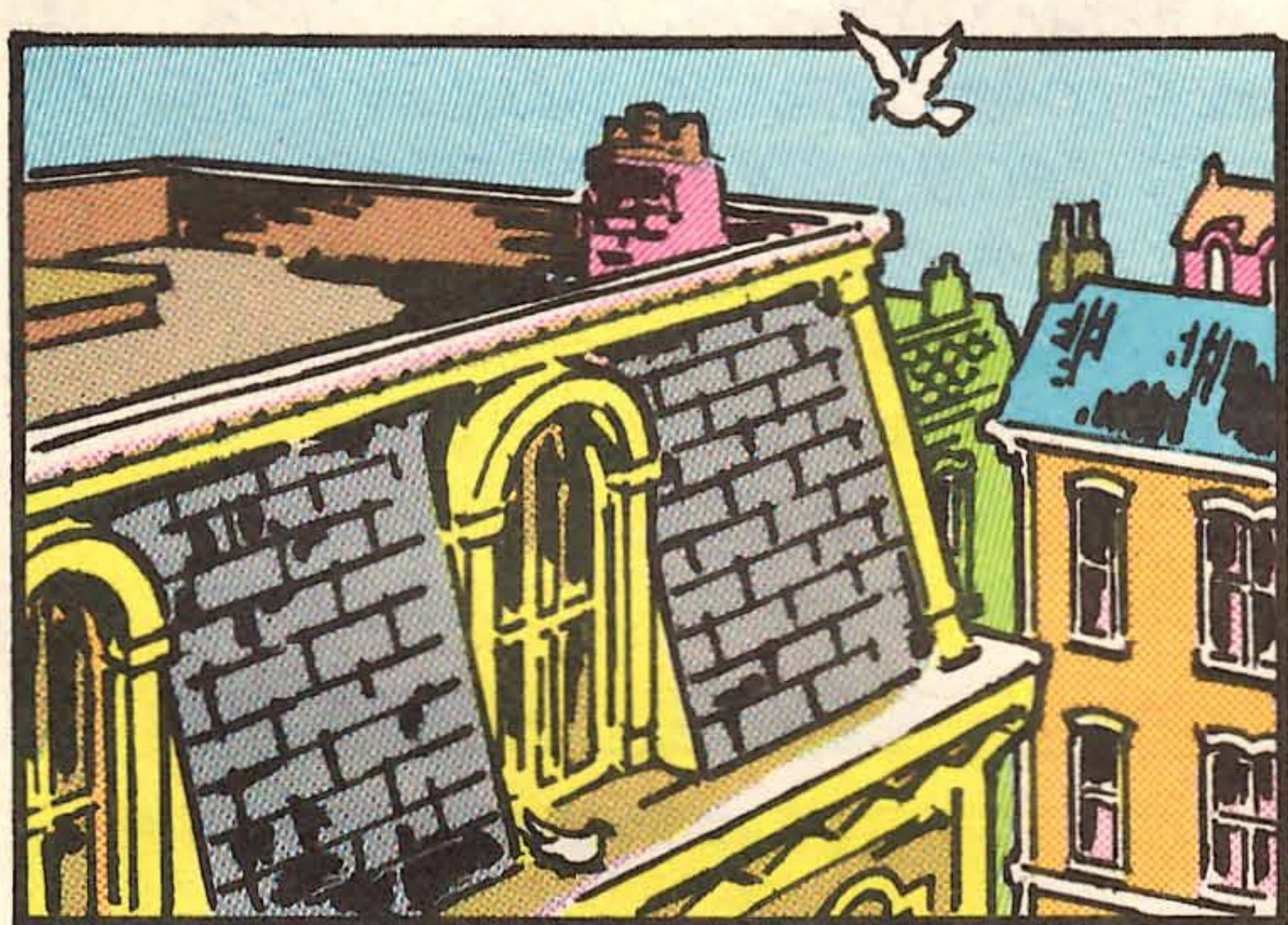
BY THE 1970'S, PORTABLE AND HAND-HELD CASSETTE TAPE RECORDERS WERE POPULAR IN OUR COUNTRY. THEN CAME THE VCR'S (VIDEO CASSETTE RECORDERS) IN THE 1980'S... JUST OVER A CENTURY (100 YEARS) AFTER THOMAS EDISON'S INVENTION OF THE PHONOGRAPH. TODAY, REMOTE CONTROL VCR'S LIKE THIS REALISTIC VHS MODEL LET YOU USE YOUR TELEVISION SET TO WATCH MOVIES AND SPECIAL EDUCATIONAL SUBJECTS IN YOUR OWN LIVING ROOM.



ONLY 111 YEARS SINCE THE FIRST PHONE CALL!

JUST THINK HOW MUCH WE RELY ON ALEXANDER GRAHAM BELL'S INVENTION... THE TELEPHONE... TO COMMUNICATE IN EVERYDAY FAMILY LIFE, AND IN BUSINESS AND GOVERNMENT. ALSO, THINK HOW MANY OTHER FABULOUS INVENTIONS HAVE BEEN MADE DURING THE TELEPHONE AGE ON PLANET EARTH — IN ONLY 111 YEARS OUT OF THOUSANDS OF YEARS IN THE HISTORY OF MANKIND!

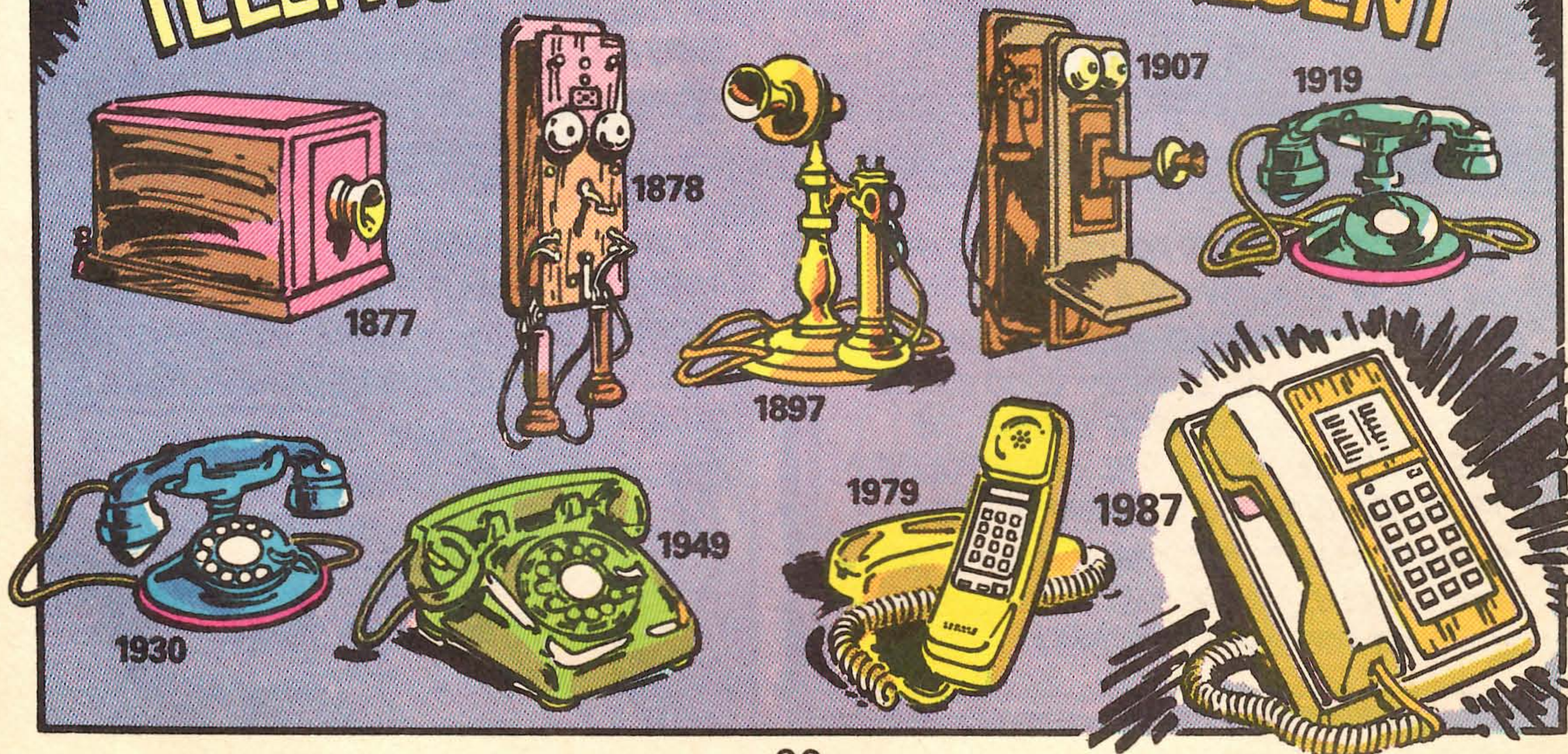
BELL'S FIRST TELEPHONE PATENT WAS ISSUED MARCH 7, 1876 ... AND JUST THREE DAYS LATER, ON THE TOP FLOOR OF A BOARDINGHOUSE AT NO. 5 EXETER PLACE, BOSTON, MASSACHUSETTS, THE TELEPHONE CARRIED ITS FIRST VOICE SOUND.



MR. BELL... I HEARD EVERY WORD YOU SAID, DISTINCTLY!



TELEPHONES - PAST AND PRESENT



11 YEARS ON PLANET EARTH —the Telephone Age!

DURING THE YEARS FOLLOWING THE FIRST PHONE CALL, MANY DESIGN IMPROVEMENTS WERE MADE, INCLUDING THE DIAL TELEPHONE, AN INVENTION OF ALMON B. STROWGER... THE FOUNDER OF AUTOMATIC ELECTRIC COMPANY.

THE WORLD'S FIRST DIAL TELEPHONE SYSTEM BEGAN OPERATION AT LA PORTE, INDIANA, U.S.A. NOVEMBER 3, 1892 — A GREAT CONVENIENCE WE STILL ENJOY 95 YEARS LATER!



ON JUNE 22, 1955 AT CLARENVILLE, NEW FOUNDLAND, THE CABLE SHIP HMCS MONARCH BEGAN PAYING OUT FROM HUGE REELS ON ITS DECK THE FIRST TELEPHONE CABLE TO SPAN THE ATLANTIC OCEAN — ITS DESTINATION: GLASGOW, SCOTLAND, 2,500 MILES AWAY.



THE CABLE CARRIED ITS FIRST VOICE COMMUNICATION SEPTEMBER 25, 1956. THIS MARVELOUS ACHIEVEMENT WAS THE RESULT OF A JOINT VENTURE BETWEEN AMERICAN TELEPHONE & TELEGRAPH COMPANY, THE BRITISH POST OFFICE, AND CANADA

ADDITIONAL CABLES FOLLOWED THE FAMOUS FIRST — WHICH HAD A CAPACITY OF ONLY 37 SEPARATE TELEPHONE CALLS. BY CONTRAST, THE 1983 CABLE COULD CARRY 9,000 SEPARATE CALLS. SOON, A SUPER CABLE, THE AT&T FIBER-OPTIC TYPE USING PULSES OF LASER LIGHT, WILL CARRY 40,000 SEPARATE CALLS! THIS CABLE, LINKING THE UNITED STATES, EUROPE AND JAPAN IS EXPECTED TO GO INTO SERVICE IN 1988.

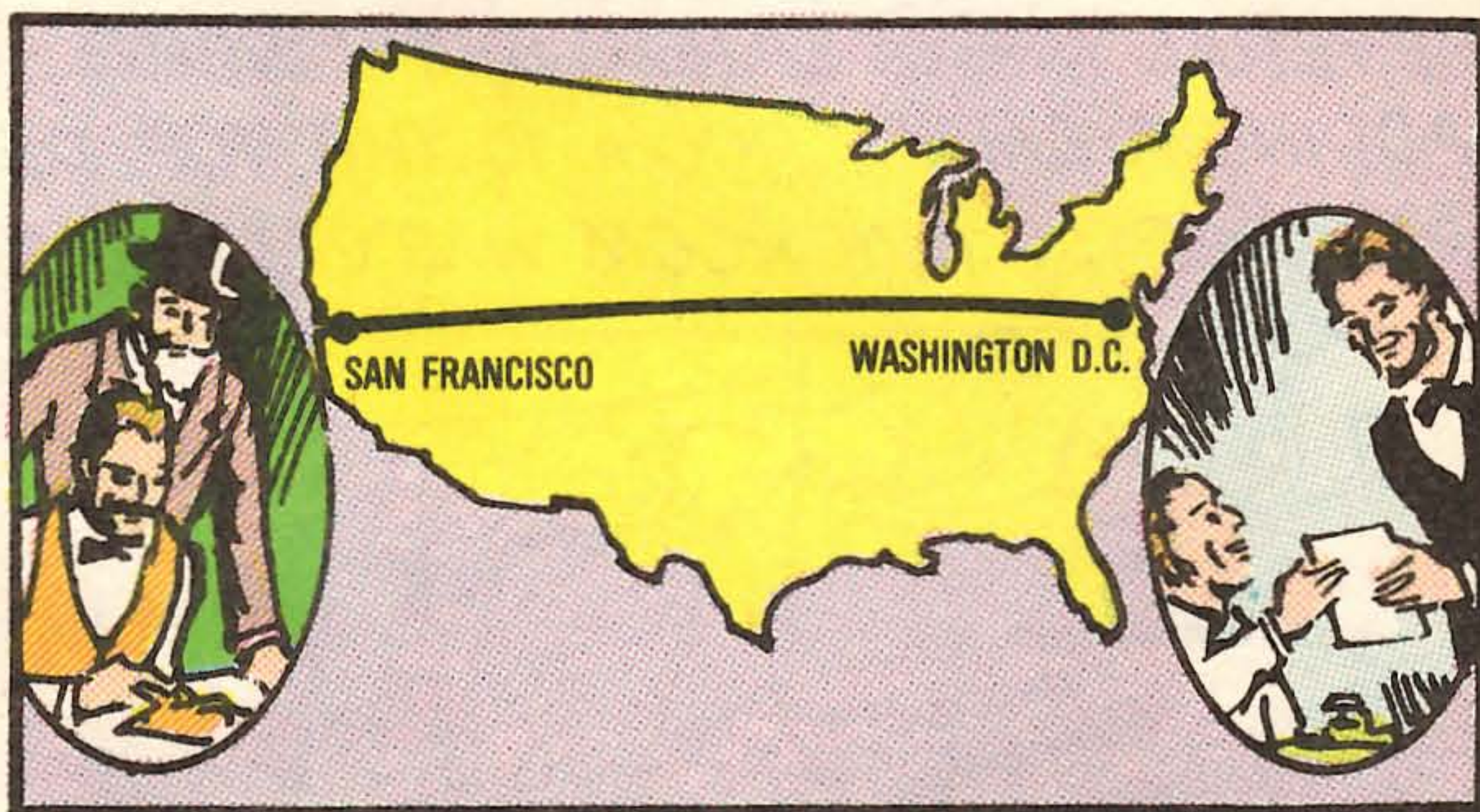
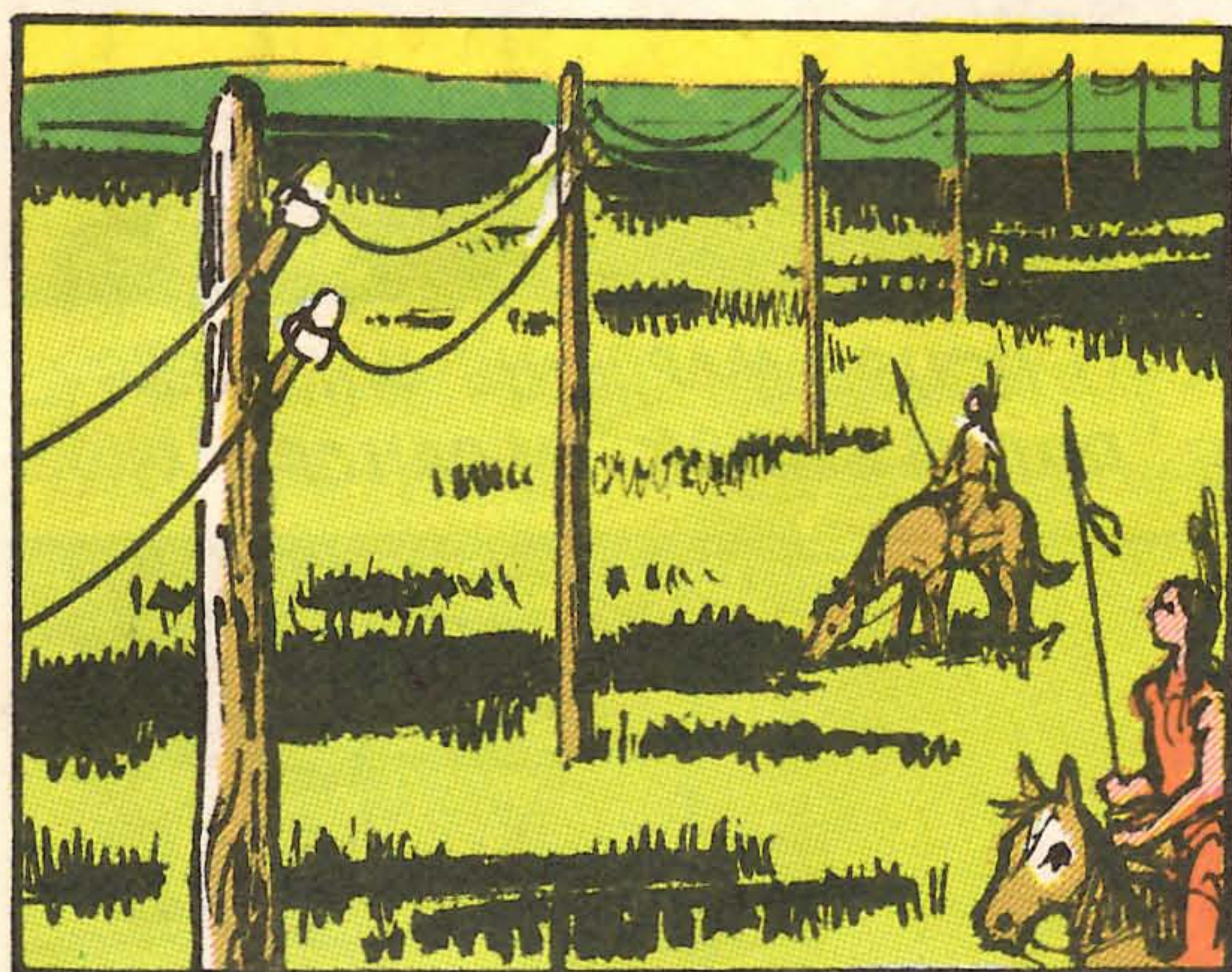
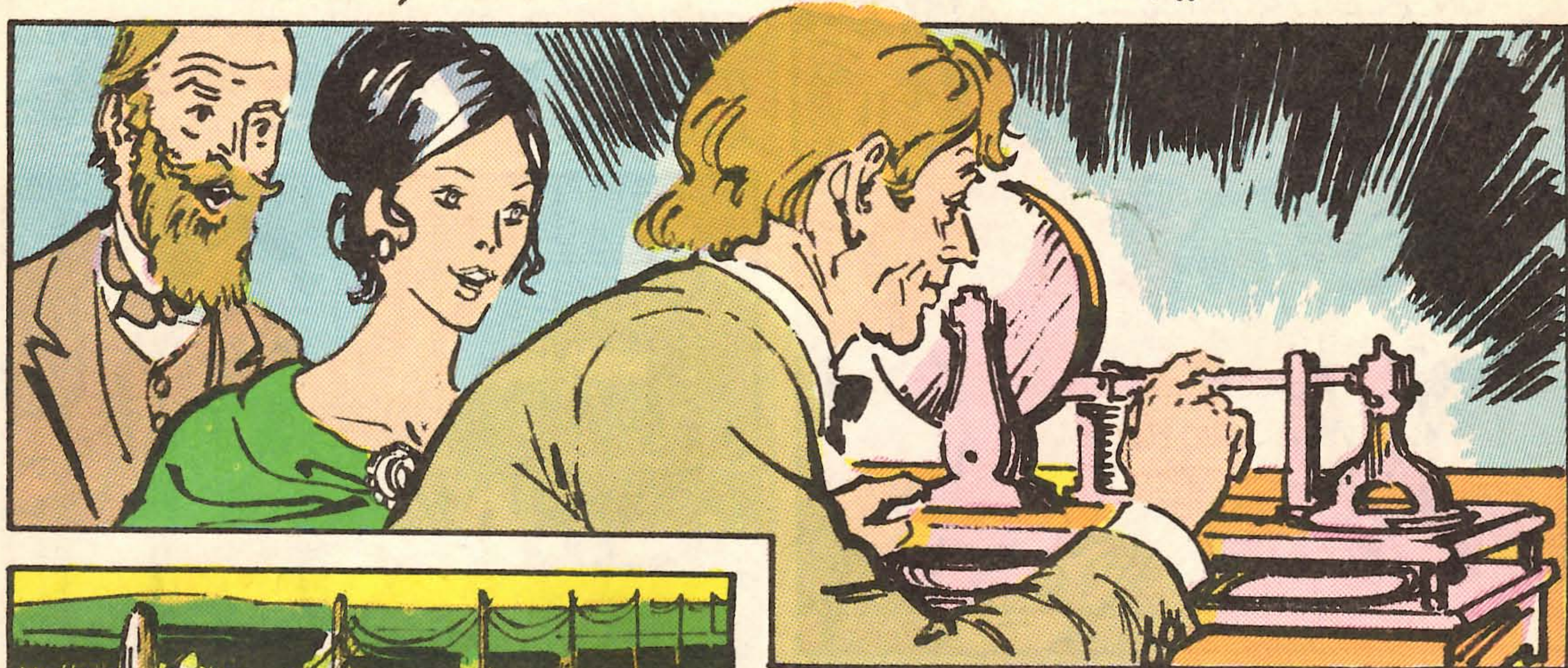
BUT REMEMBER, THE TELEGRAPH CABLE — LINKING THE U.S. AND EUROPE BEGAN SERVICE IN 1869 — 87 YEARS BEFORE THE TELEPHONE (VOICE) CABLE!

MS. JONES, PLEASE TELL US MORE ABOUT THE TELEGRAPH!



THE TELEPHONE ALSO HAD TO HAVE SOME HELP FROM ELECTRONICS IN THE FORM OF THE AUDION, LEE DE FOREST'S AMPLIFYING RADIO TUBE. IT MADE POSSIBLE LONG-DISTANCE CALLS. IN 1915, THE FIRST CROSS-COUNTRY TELEPHONE CALL TOOK 20 MINUTES BECAUSE OF THE MANY MANUAL LONG DISTANCE SWITCHBOARD CONNECTIONS WHICH HAD TO BE MADE. TODAY, WITH AUTOMATIC SWITCHING, THE CALL TAKES ONLY A SECOND OR SO!

IN 1837, AT THE AGE OF 44, **SAMUEL MORSE**, A PORTRAIT ARTIST, BUILT THE FIRST PRACTICAL TELEGRAPH SOUNDER. THE FIRST TELEGRAM, "WHAT HATH GOD WROUGHT," WAS SENT FROM BALTIMORE IN 1844.

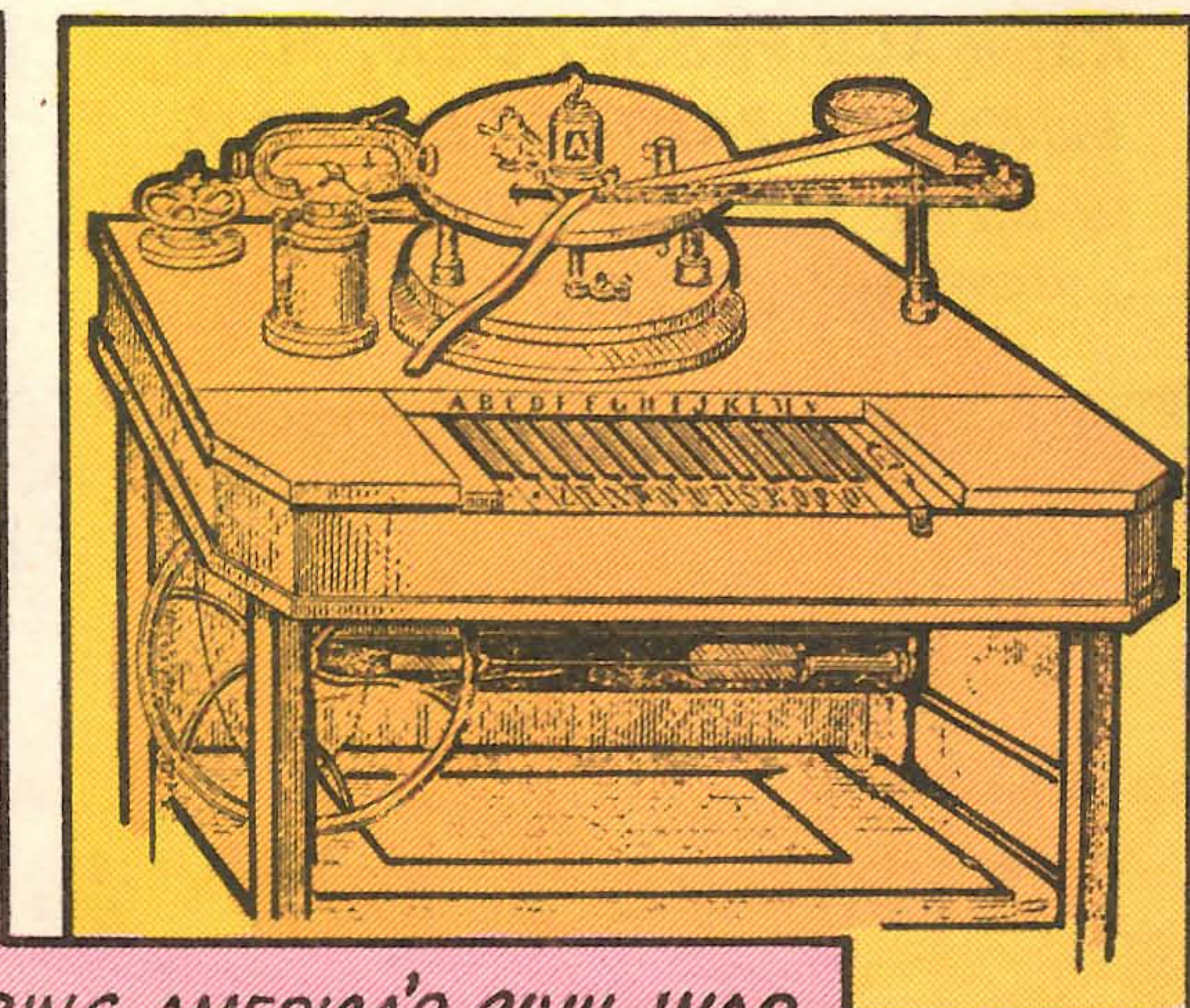


HIS WIRE TELEGRAPH WAS THE FIRST PRACTICAL LONG-RANGE COMMUNICATIONS SYSTEM. IN 1861, **STEPHEN FIELD** SENT THE FIRST TRANSCONTINENTAL TELEGRAPH MESSAGE TO PRES. LINCOLN...

... FROM SAN FRANCISCO, CALIFORNIA TO WASHINGTON, D.C. AND THE YOUNG TELEGRAPH SYSTEM GOT ITS BAPTISM OF FIRE DURING THE U.S. CIVIL WAR WHICH BEGAN THAT YEAR.

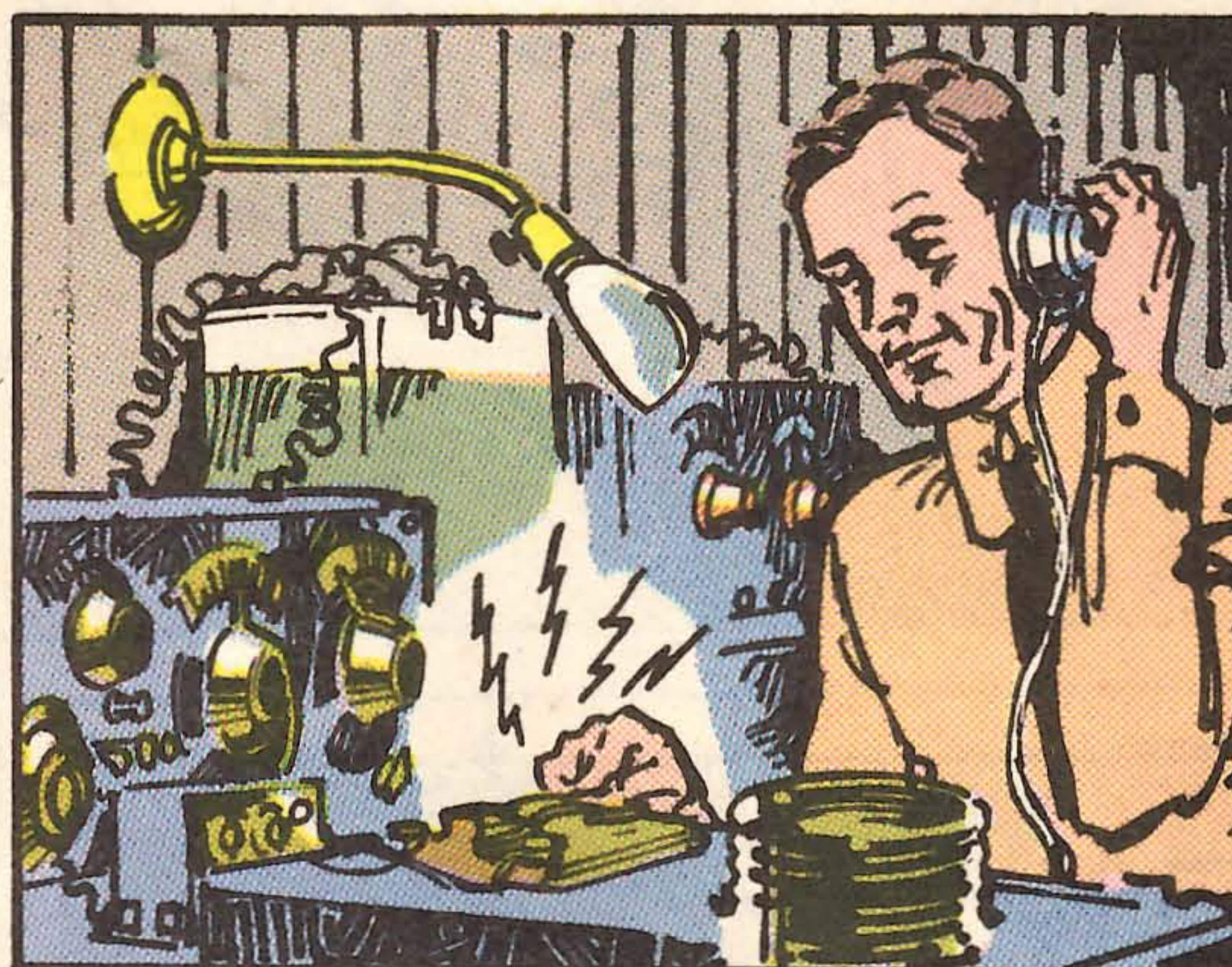


IN JULY, 1861, U. S. GEN. **McCLELLAN** CLAIMED FIRST USE OF THE TELEGRAPH UNDER ACTUAL BATTLE CONDITIONS. ALSO USED LATER DURING AMERICA'S CIVIL WAR WAS THE **TELEGRAPH PRINTER**, INVENTED BY **ROYAL HOUSE** OF VERMONT. IT USHERED IN A NEW ERA IN RAPID COMMUNICATIONS.





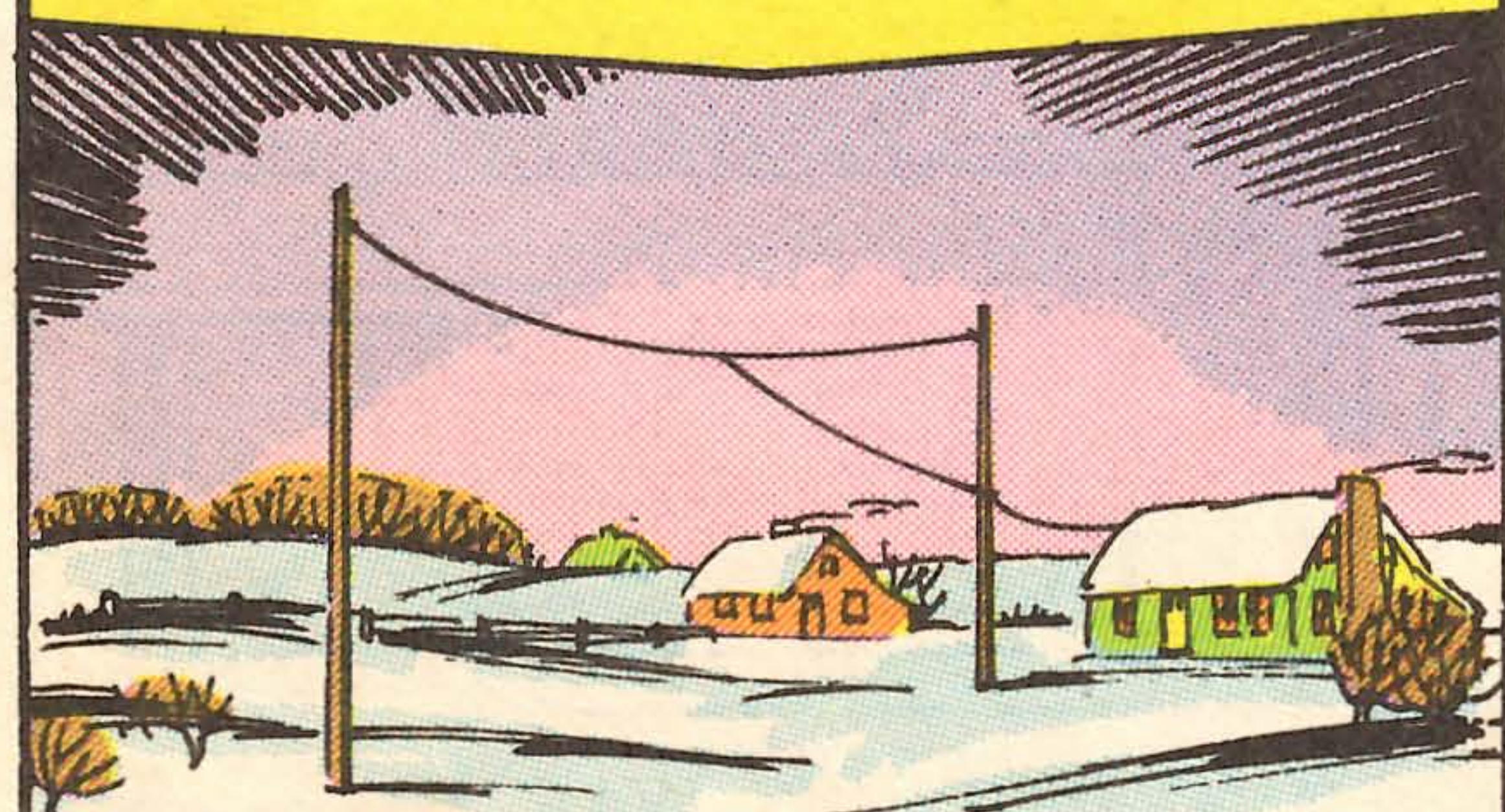
ON DECEMBER 12, 1901, GUGLIELMO MARCONI SENT THE FIRST TRANS-ATLANTIC WIRELESS MESSAGE FROM ENGLAND TO ST. JOHN'S, NEWFOUNDLAND. IT MARKED THE BEGINNING OF LONG-RANGE RADIO COMMUNICATION.



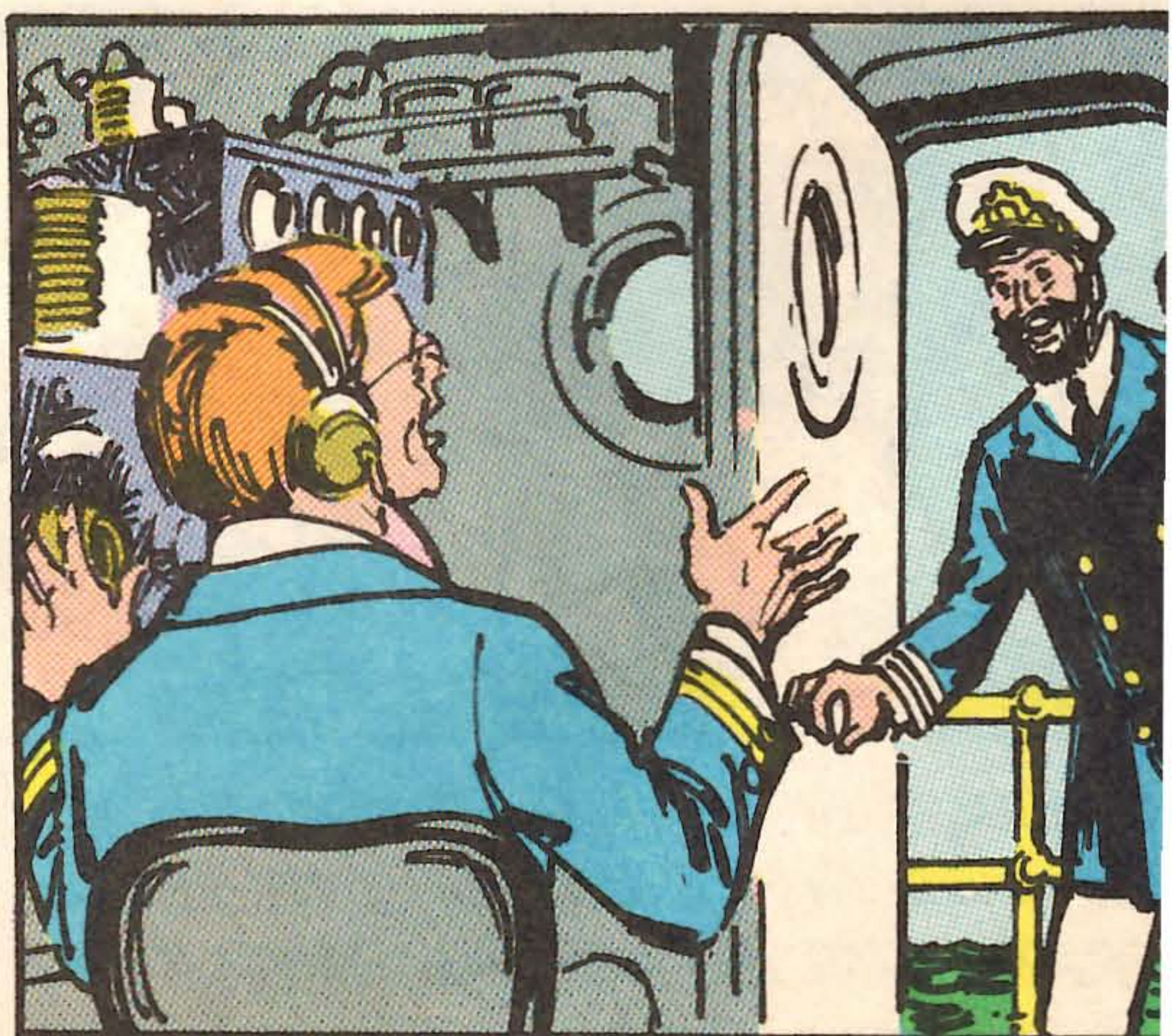
SEVERAL YEARS LATER, SHIPS WERE ADDING A SMALL ROOM TO THE TOP DECK TO HOUSE MARCONI'S WIRELESS RADIO SETS. THIS ROOM WAS CALLED THE "RADIO SHACK" BY SAILORS.



A CANADIAN-AMERICAN INVENTOR, **REGINALD FESSENDEN**, MADE HISTORY ON CHRISTMAS EVE, 1906, WHEN HE SENT THE FIRST VOICE AND MUSIC BY "WIRELESS" (RADIO)



FROM A WIRELESS STATION AT BRANT ROCK, MASSACHUSETTS...



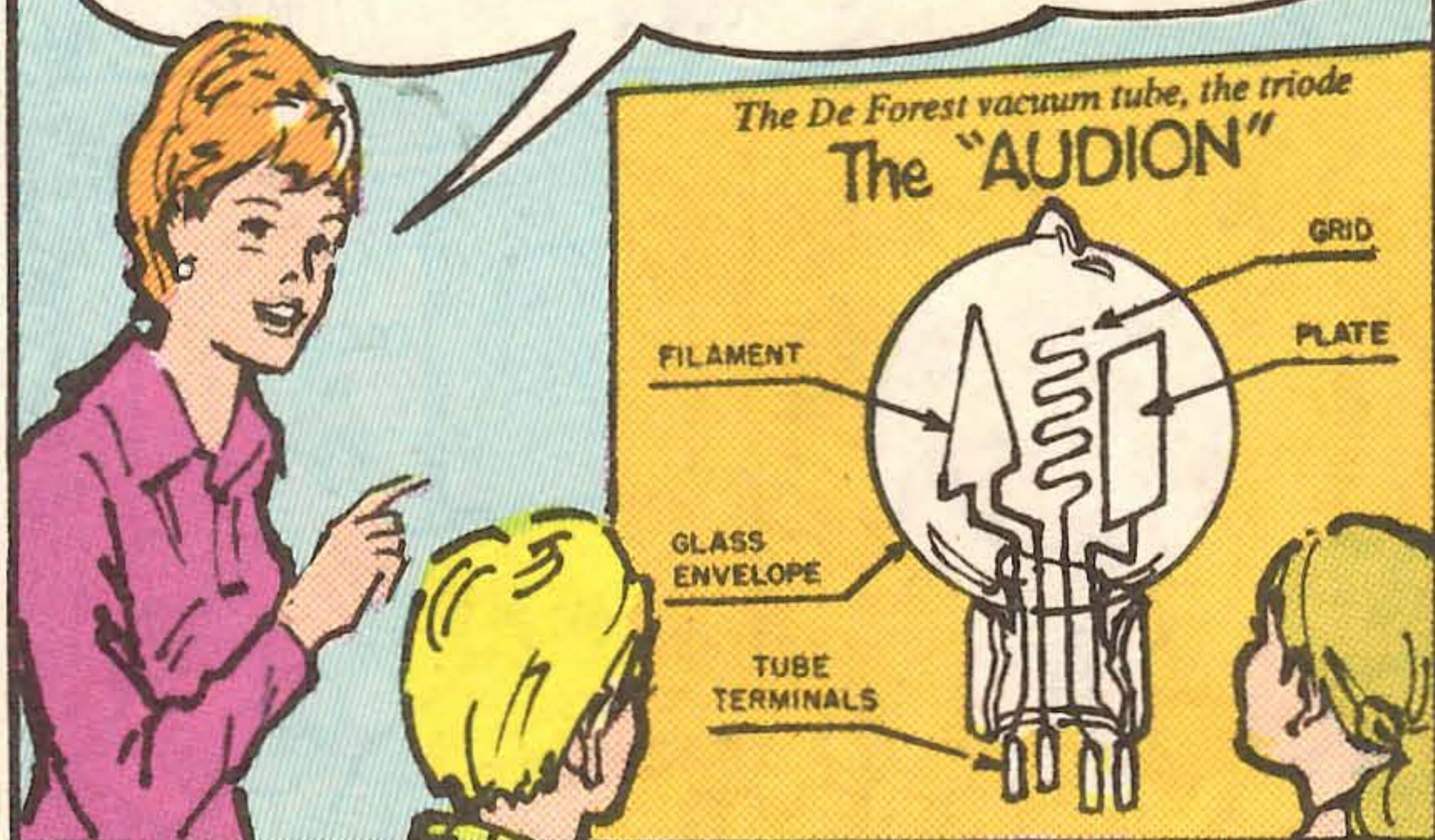
...HEARD BY MANY AMAZED WIRELESS OPERATORS ABOARD SHIPS AT SEA HUNDREDS OF MILES AWAY.

BOB, WHAT REVOLUTIONIZED ELECTRONICS A FEW YEARS AFTER MARCONI'S SUCCESSFUL TRANS-ATLANTIC RADIO TEST?

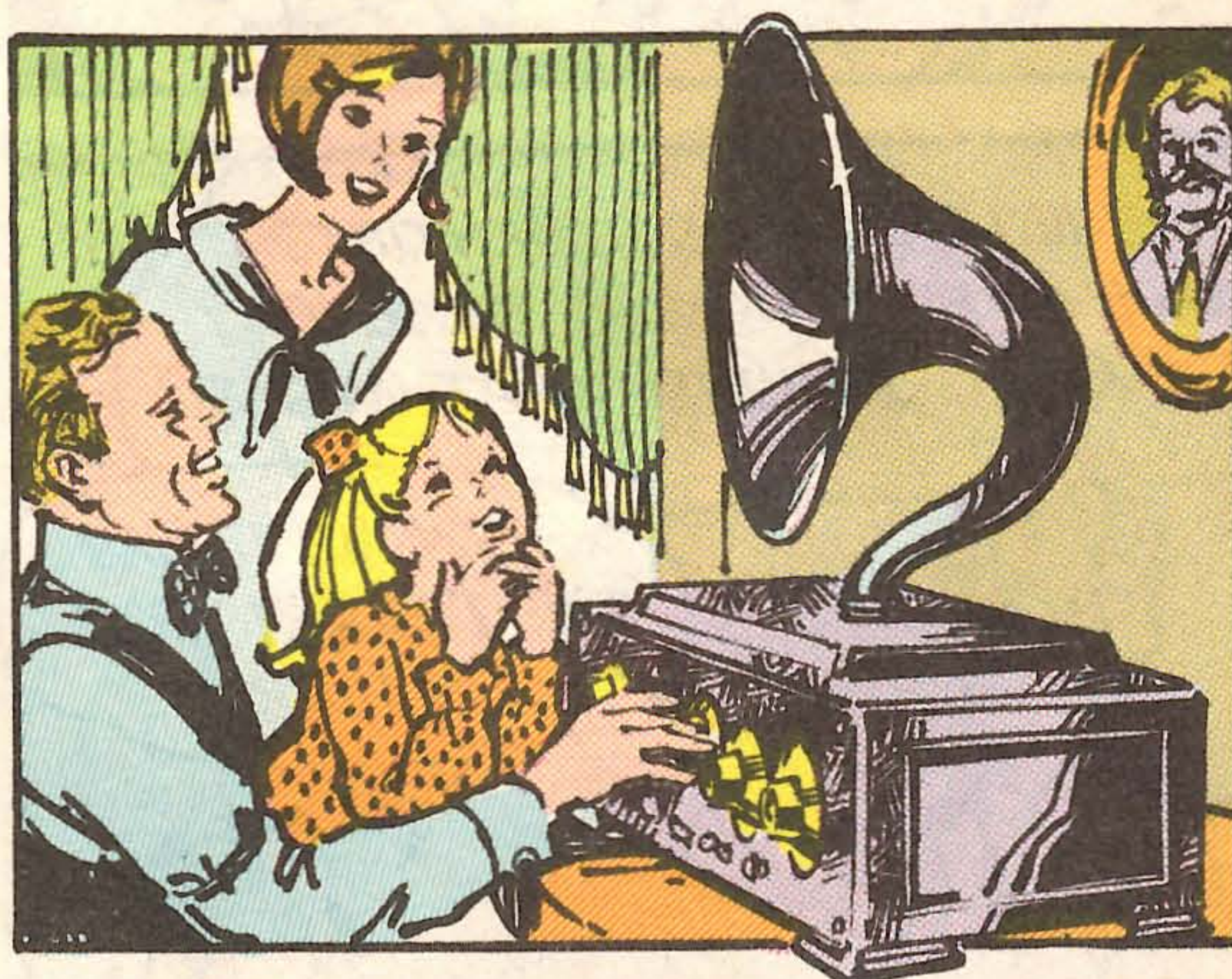
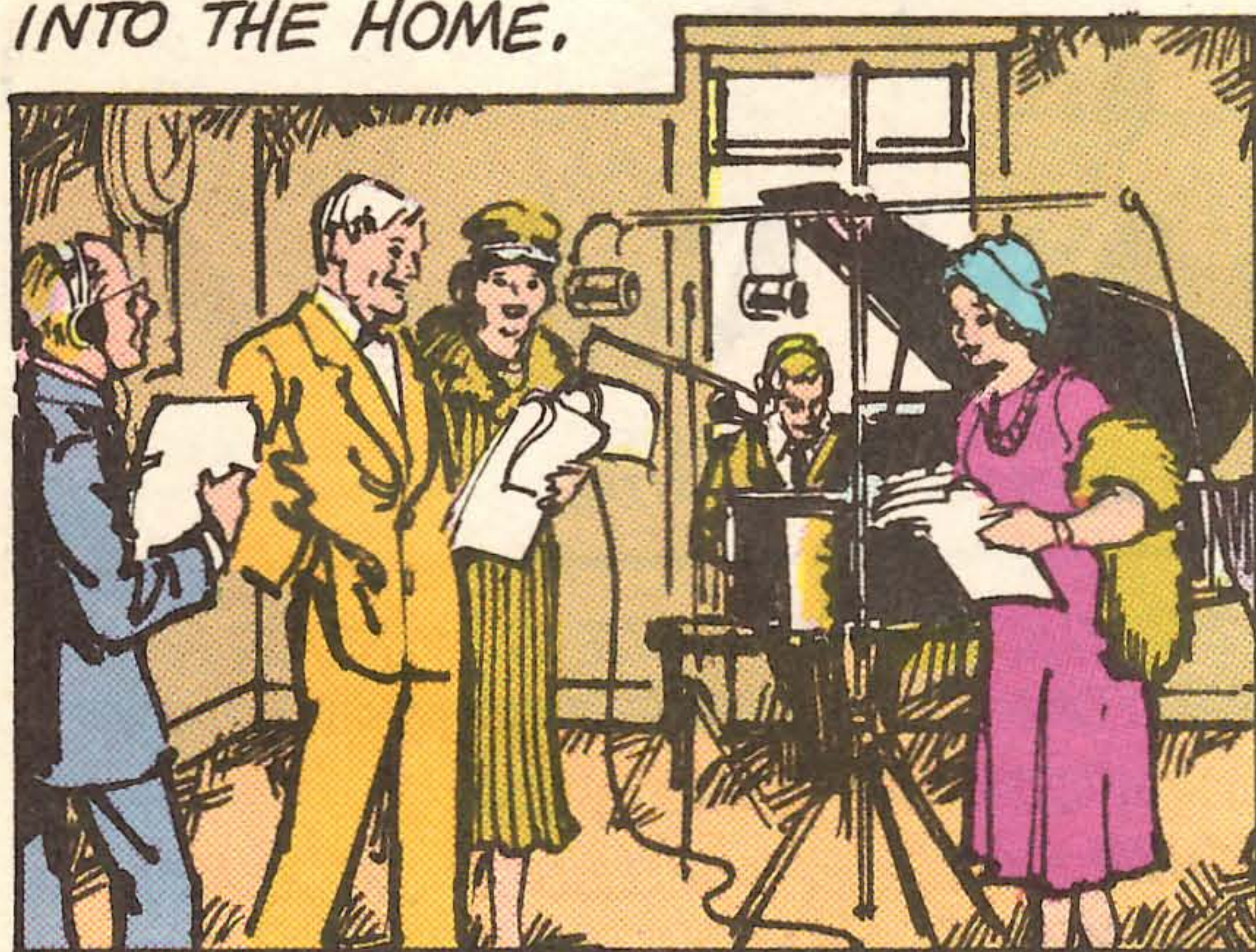
IT WAS THE DE FORREST "AUDION" RADIO TUBE IN 1915. IT MADE POSSIBLE LOUDER SOUND FROM RADIOS.



RIGHT, BOB! IN A FEW YEARS, RECEIVERS USING AUDION TUBES REVOLUTIONIZED RADIO LISTENING. —MORE STATIONS COULD BE TUNED IN... EVEN THOSE FAR AWAY!



LEE DE FORREST'S INVENTION OF THE AUDION MARKED THE BEGINNING OF REGULAR RADIO BROADCASTS INTO THE HOME.

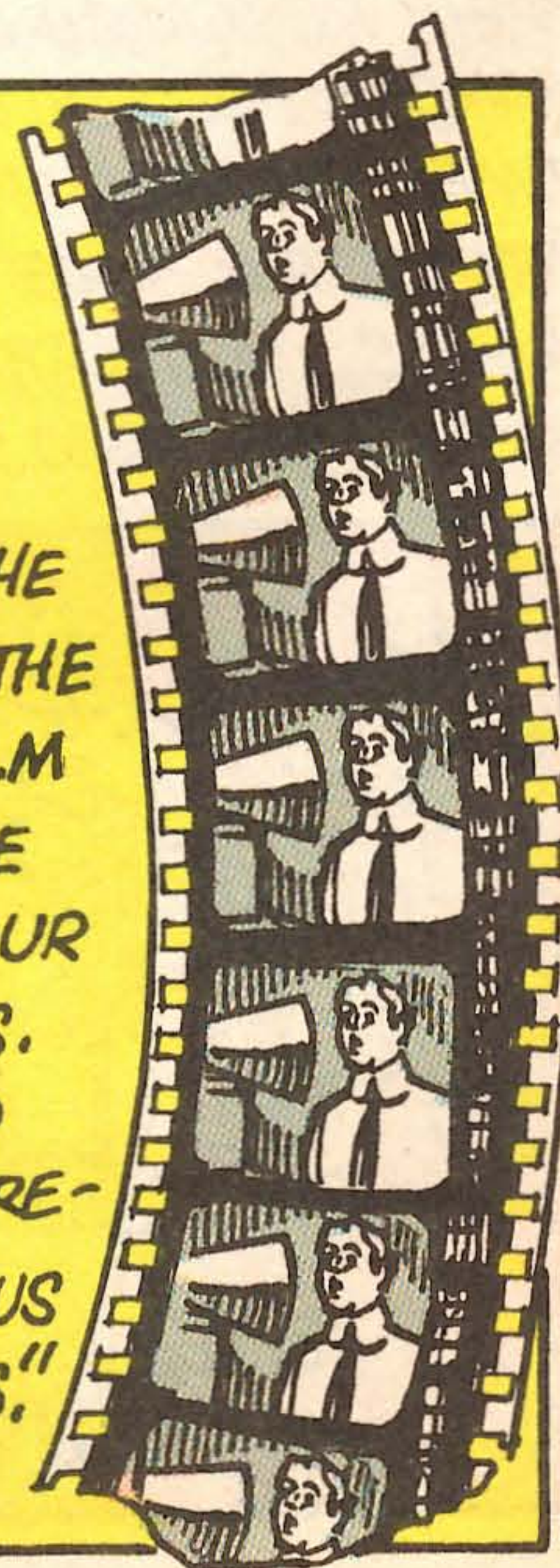


EARLY-DAY RADIO SETS WERE LARGE, AND THE LOUDSPEAKER LOOKED LIKE THE HORN OF A MUSICAL INSTRUMENT.

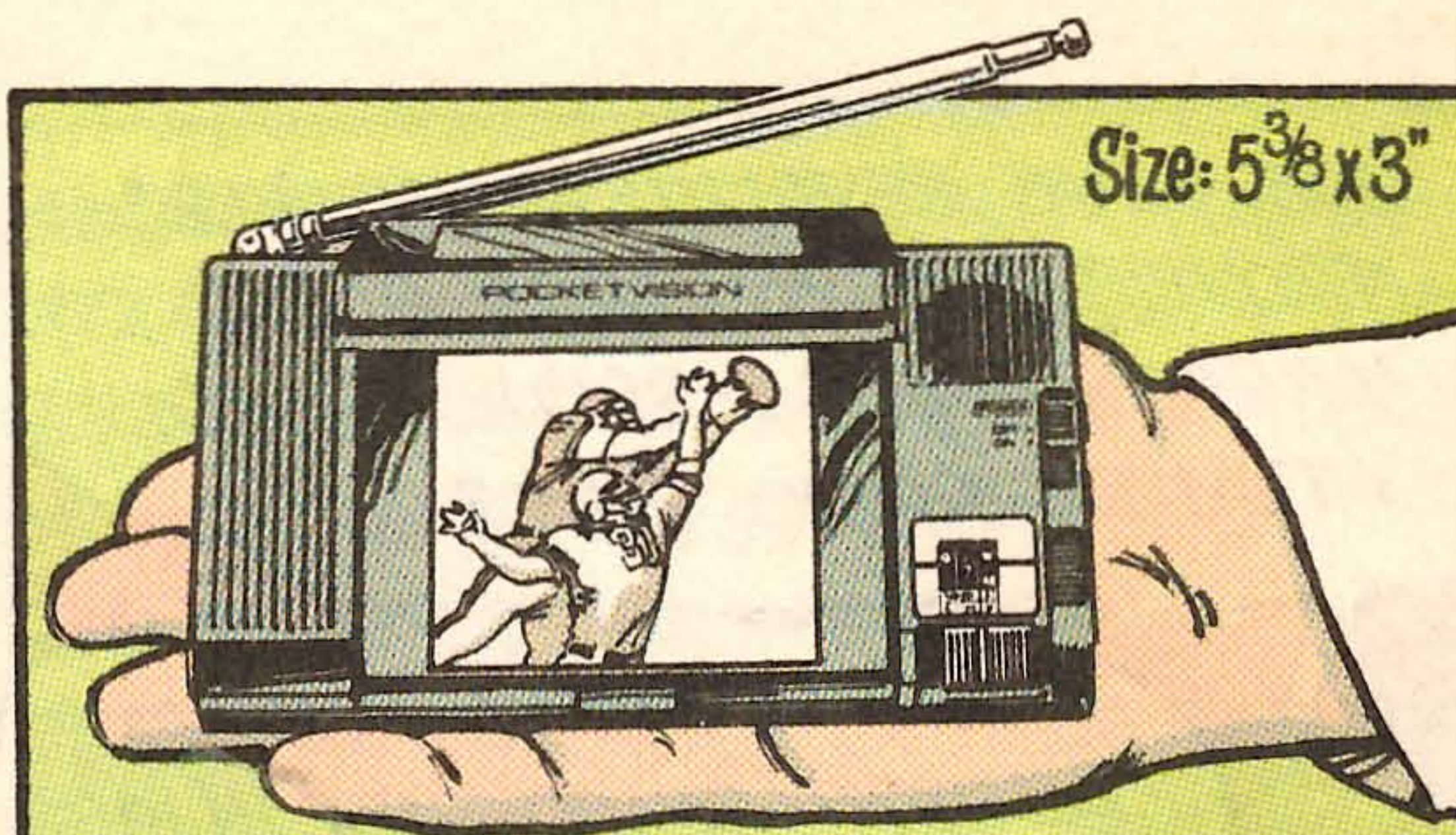
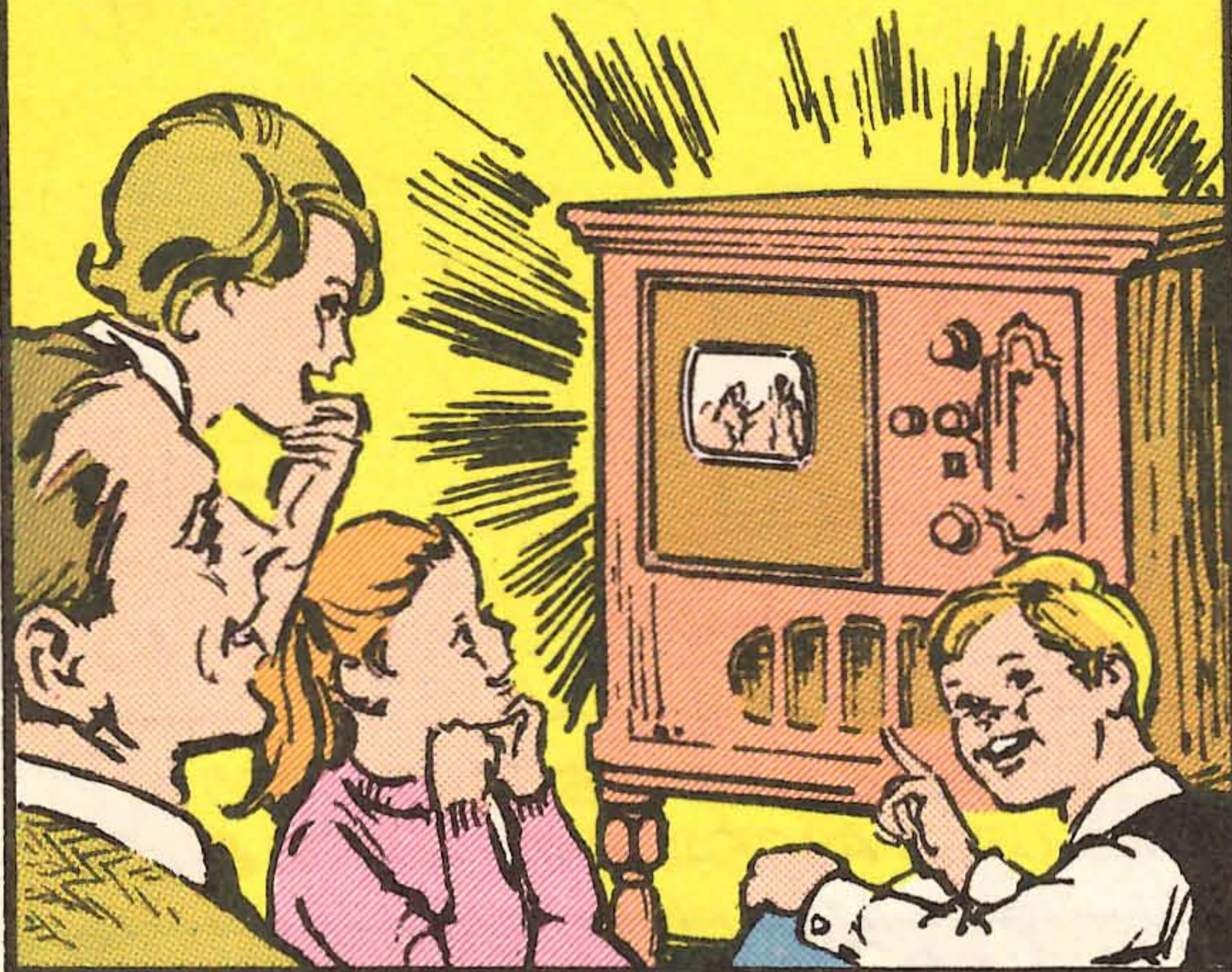


SOON, EVEN BETTER RADIO SETS WERE MADE. U.S. ARMY MAJ. EDWIN ARMSTRONG DEVELOPED THE SUPERHETERODYNE RECEIVER DURING WORLD WAR I. IT GAVE THE U.S. AND ITS ALLIES A GREAT ADVANTAGE. HE ALSO DEVELOPED FM RADIO DURING THE LATE 1930'S.

ON JUNE 9, 1922, INVENTOR/EDUCATOR JOSEPH TYKOCINER, (TICK-OH-SHINER), A POLISH IMMIGRANT TO THE U.S., DEMONSTRATED THE FIRST SOUND-ON-FILM MOTION PICTURE... THE PRINCIPLE USED IN OUR MODERN-DAY MOVIES. THE PICTURE SHOWED PROF. ELLERY PAINE RECITING LINCOLN'S FAMOUS "GETTYSBURG ADDRESS."



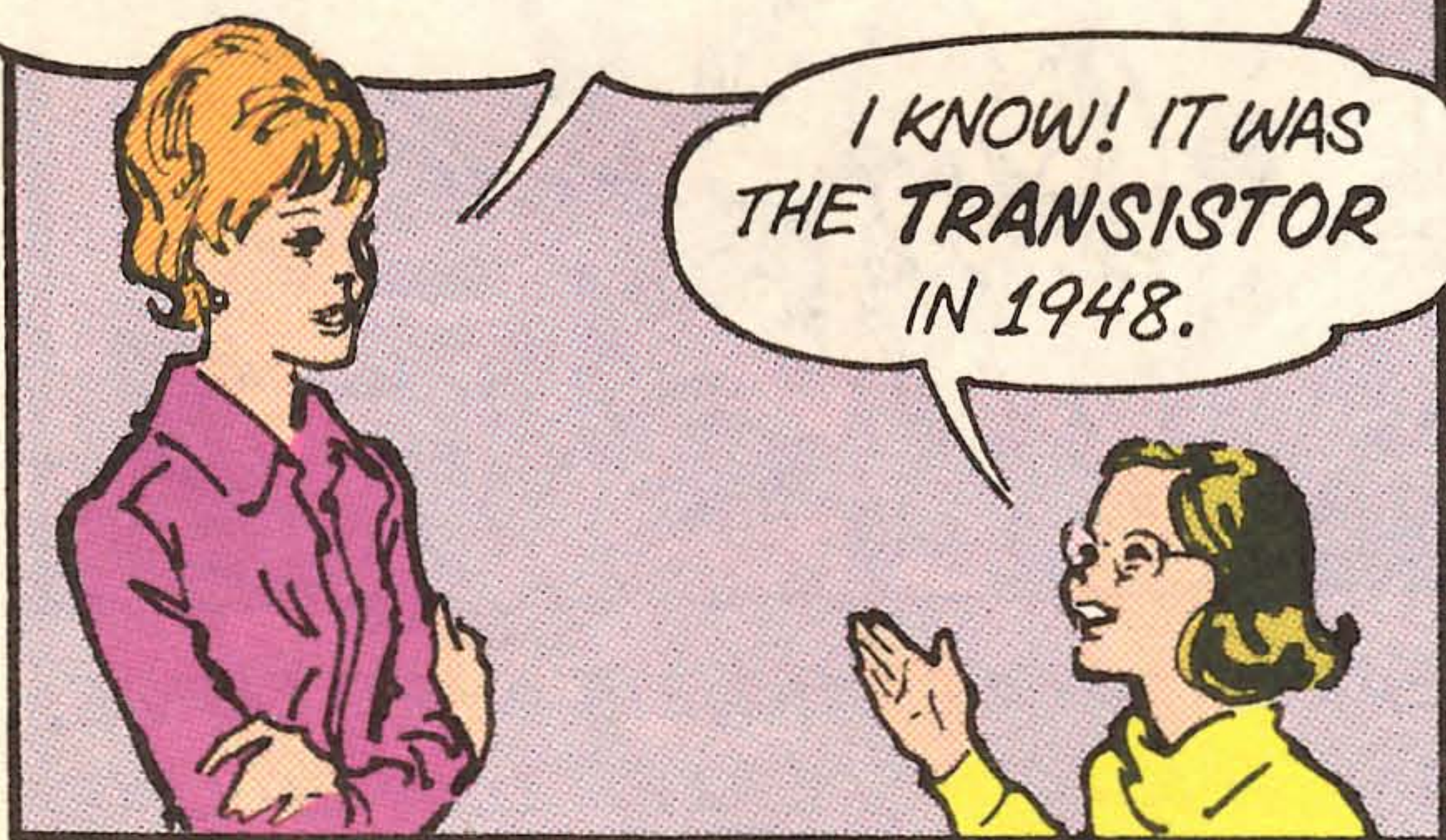
ELECTRONICS WAS A VERY ACTIVE BUSINESS AND INDUSTRIAL FIELD BY 1939. THERE WERE EVEN SOME SMALL COMMERCIAL TV SETS IN PRODUCTION.



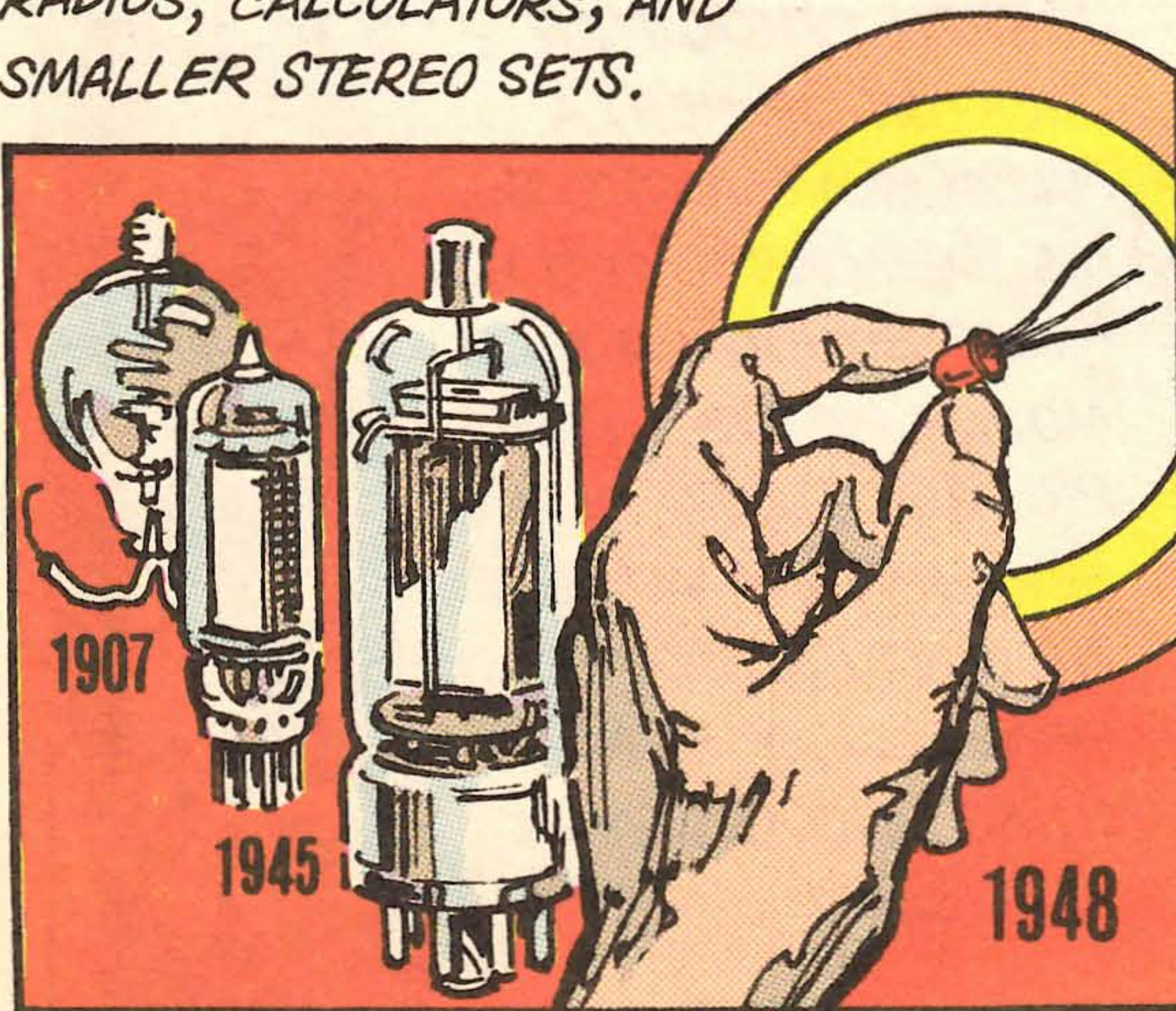
BY 1950, BLACK AND WHITE CONSOLE TV SETS WITH LARGE SCREENS BEGAN TO APPEAR, FOLLOWED IN A FEW YEARS BY COLOR TV. TODAY, WE HAVE LARGE WIDE-SCREEN TV SETS AND TINY HAND-HELD TV, LIKE THIS REALISTIC POCKETVISION POWERED BY FOUR "AAA" BATTERIES ...AND IT FITS IN YOUR POCKET!

IN THE LATE 1940'S, SCIENTISTS MADE A REVOLUTIONARY DISCOVERY FOR RADIO CIRCUITS. WHAT WAS IT?

I KNOW! IT WAS THE TRANSISTOR IN 1948.



THEIR RESEARCH WAS DONE AT WORLD FAMOUS BELL TELEPHONE LABS. MANY TIMES SMALLER THAN RADIO TUBES, THE TRANSISTOR MADE POSSIBLE POCKET RADIOS, CALCULATORS, AND SMALLER STEREO SETS.



JOHN BARDEEN

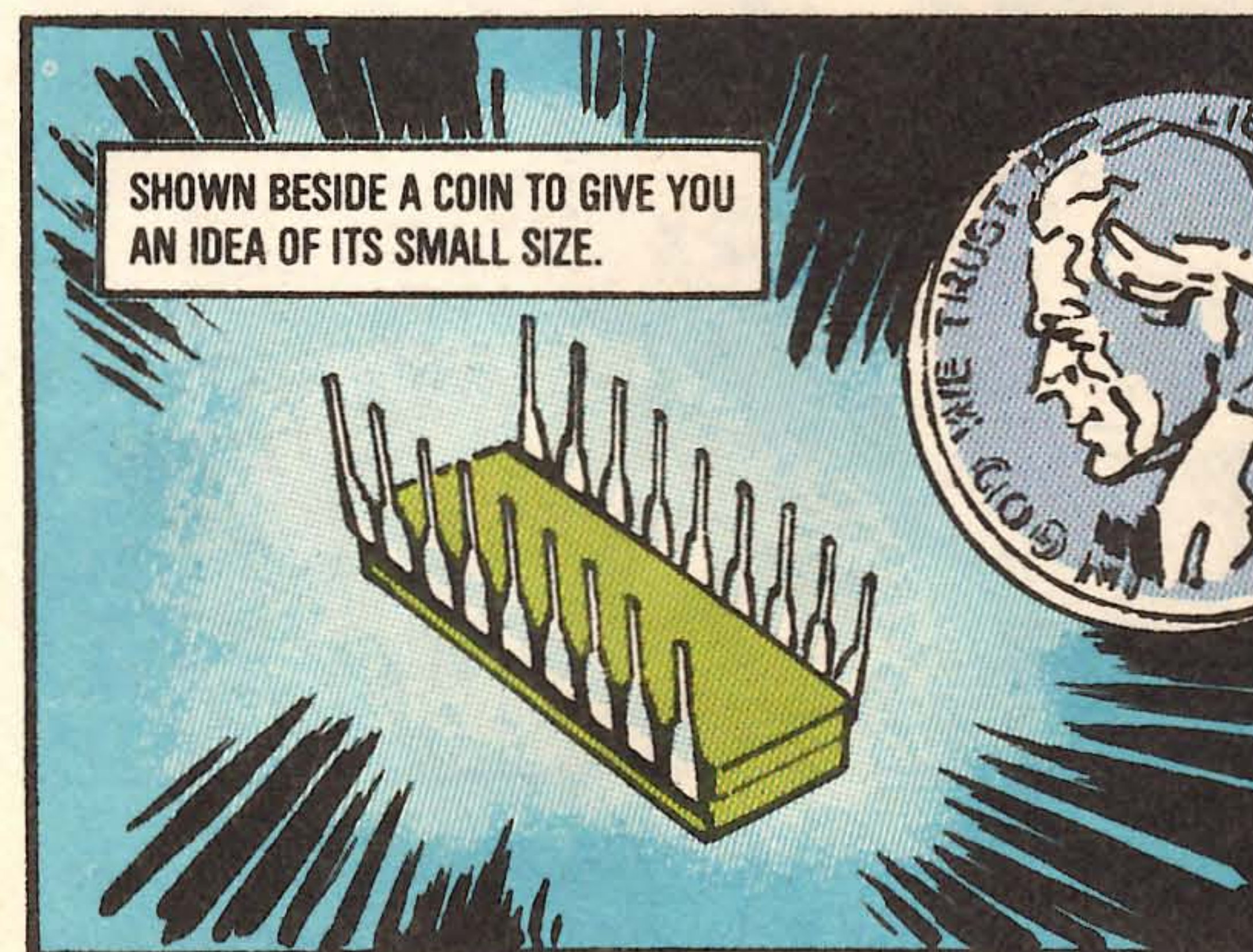


WALTER BRATTAIN



WILLIAM SHOCKLEY

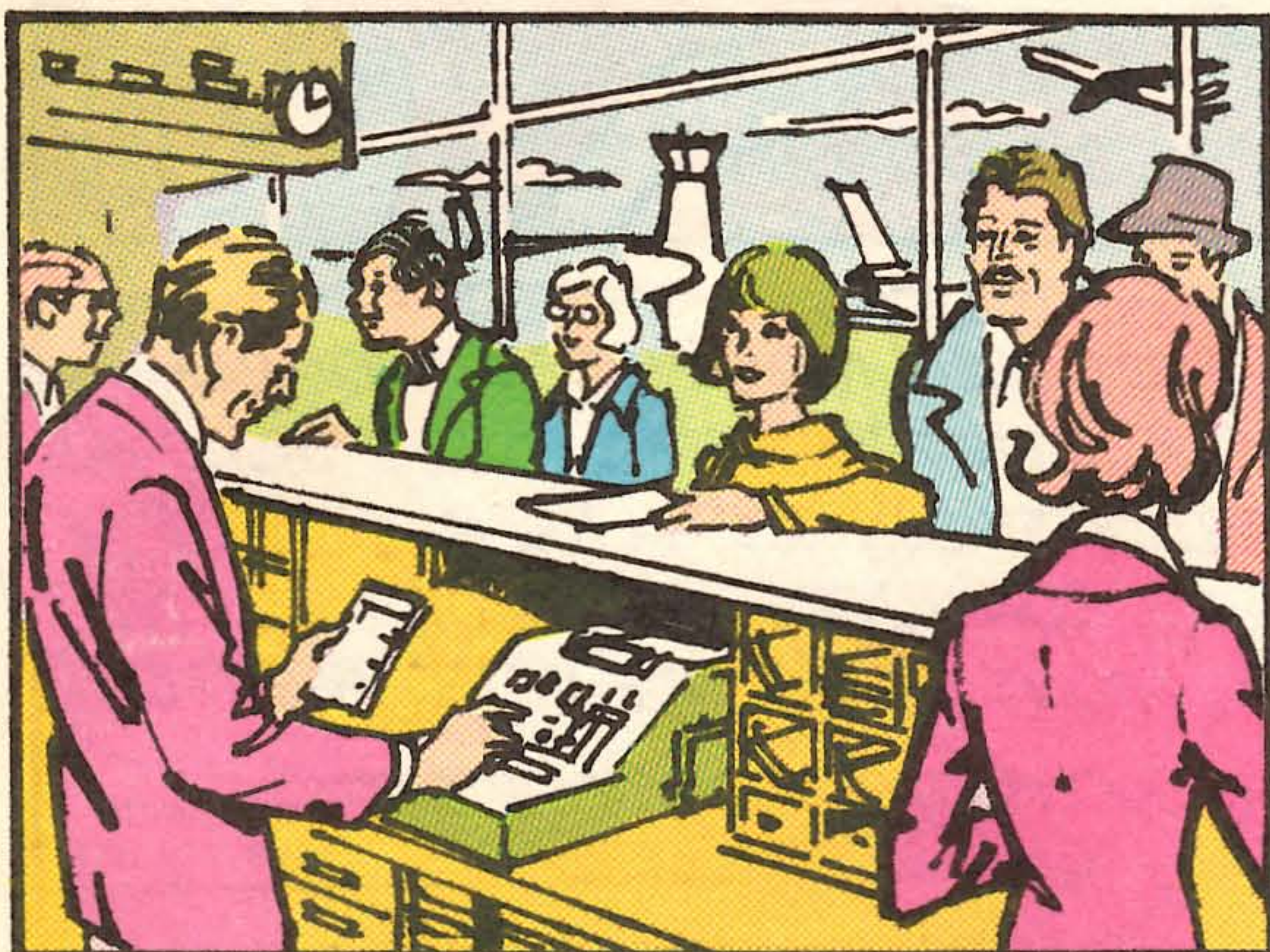
YES, THE NOBEL PRIZE IN PHYSICS WAS SPLIT BETWEEN THREE AMERICANS... FOR INVENTING THE TRANSISTOR: JOHN BARDEEN, WILLIAM SHOCKLEY AND WALTER BRATTAIN.



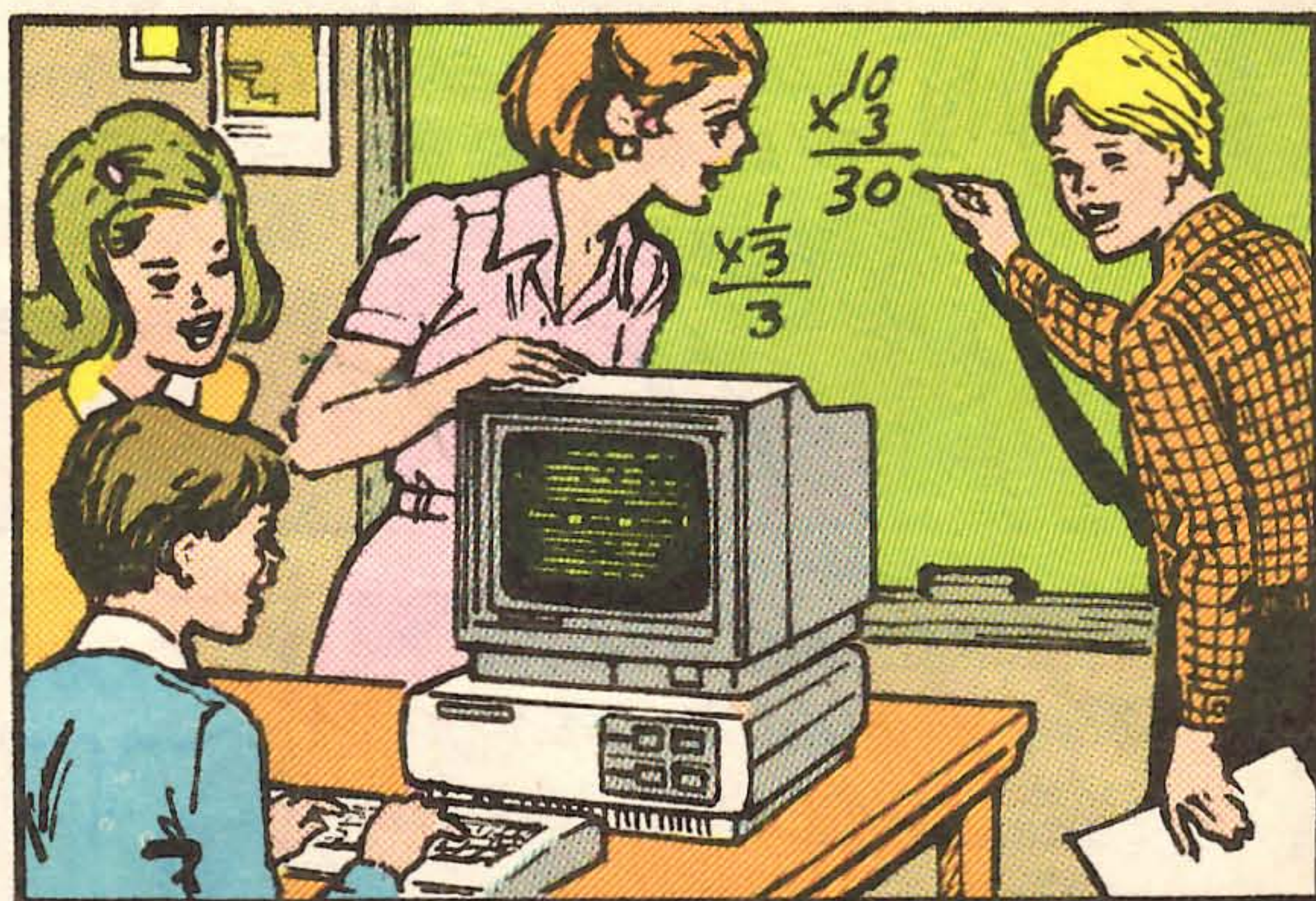
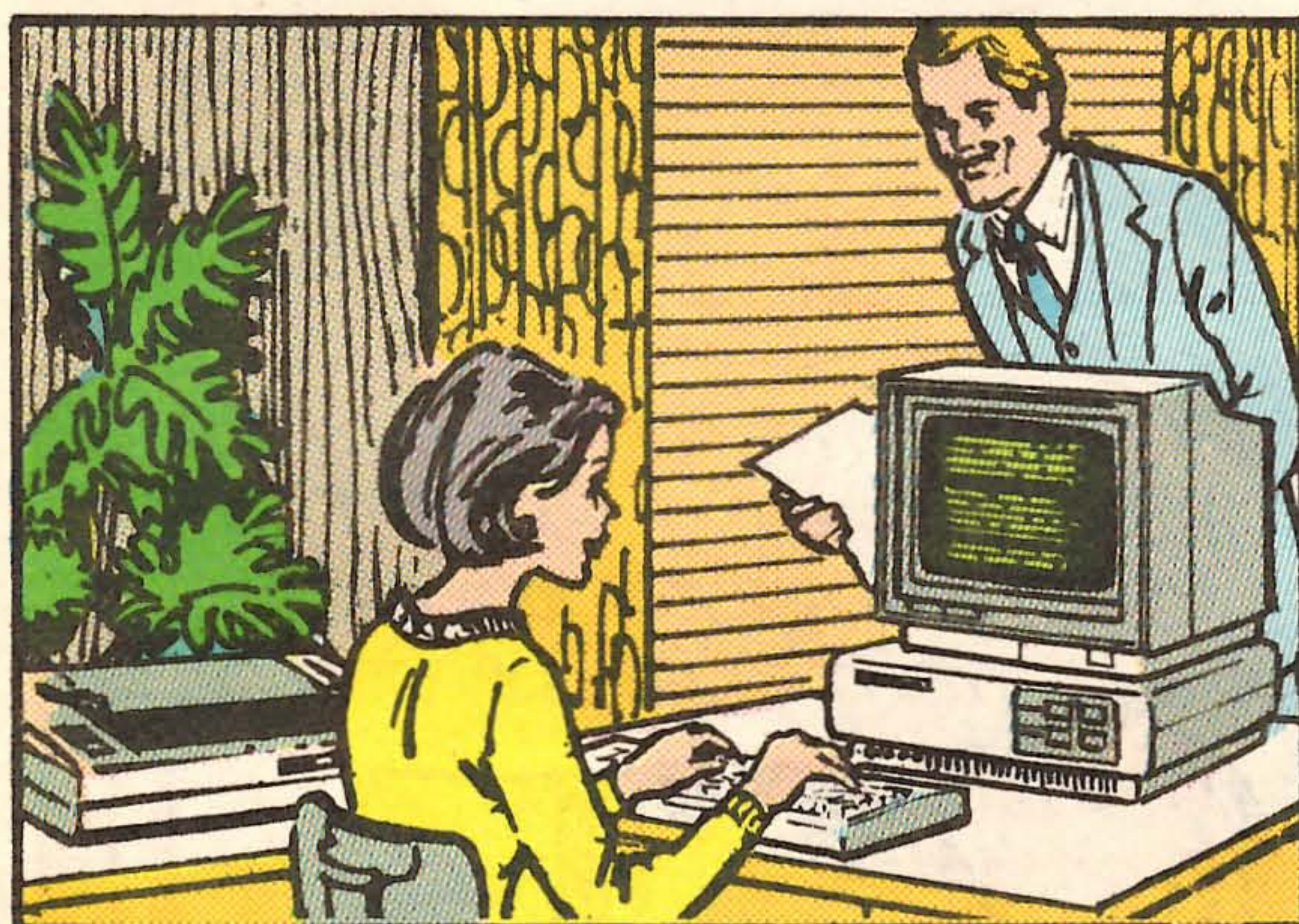
NEXT CAME THE TINY IC (INTEGRATED CIRCUIT) USED IN TODAY'S RADIOS, STEREO HI-FI SETS, AND POWERFUL DESK-SIZE HOME AND BUSINESS COMPUTERS LIKE THE TANDY 1000.

the computers!

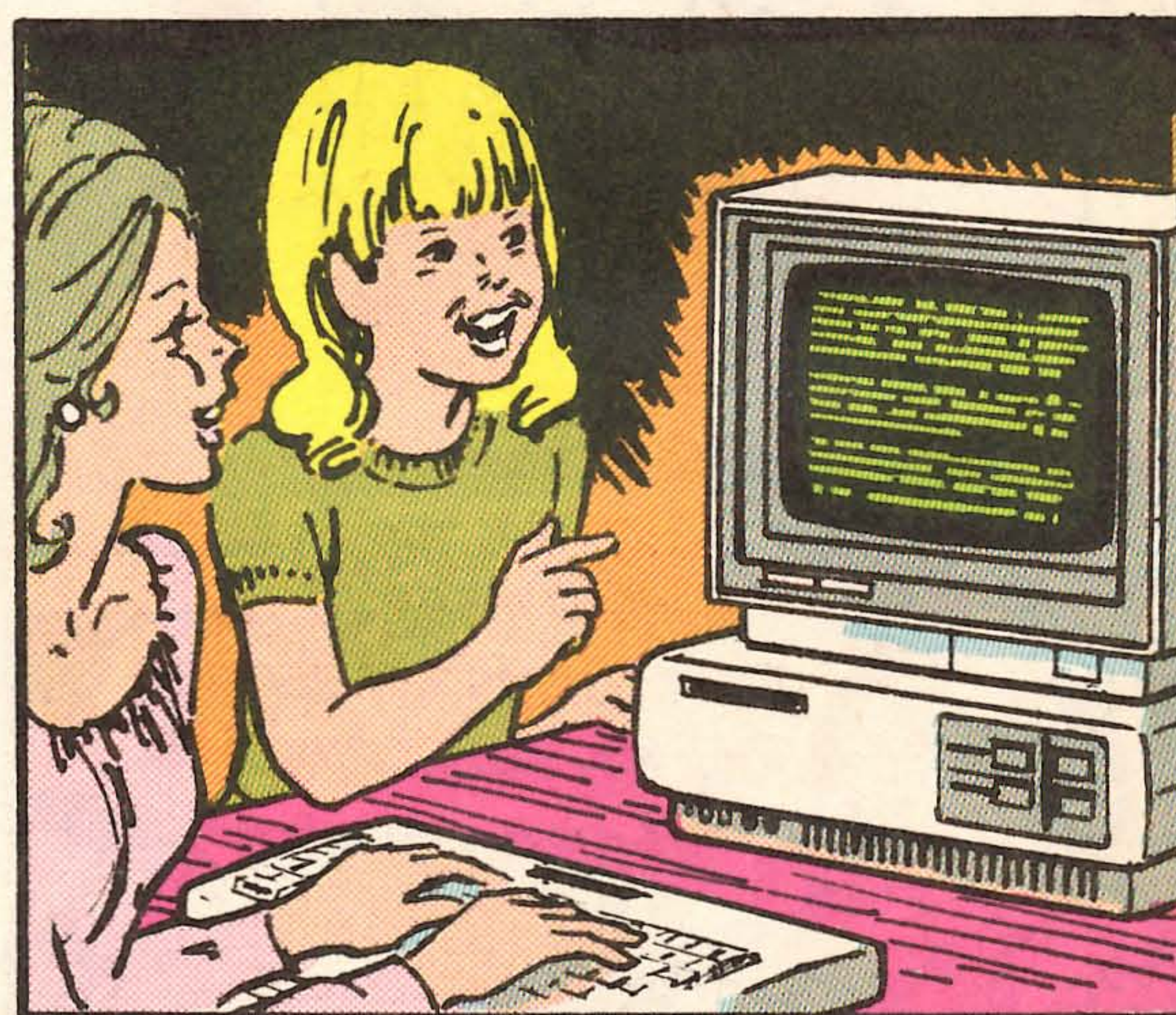
NATIONWIDE, IN CROWDED AIR TERMINALS COMPUTERS ARE SPEEDING PROCESSING OF RESERVATIONS AND TICKETS



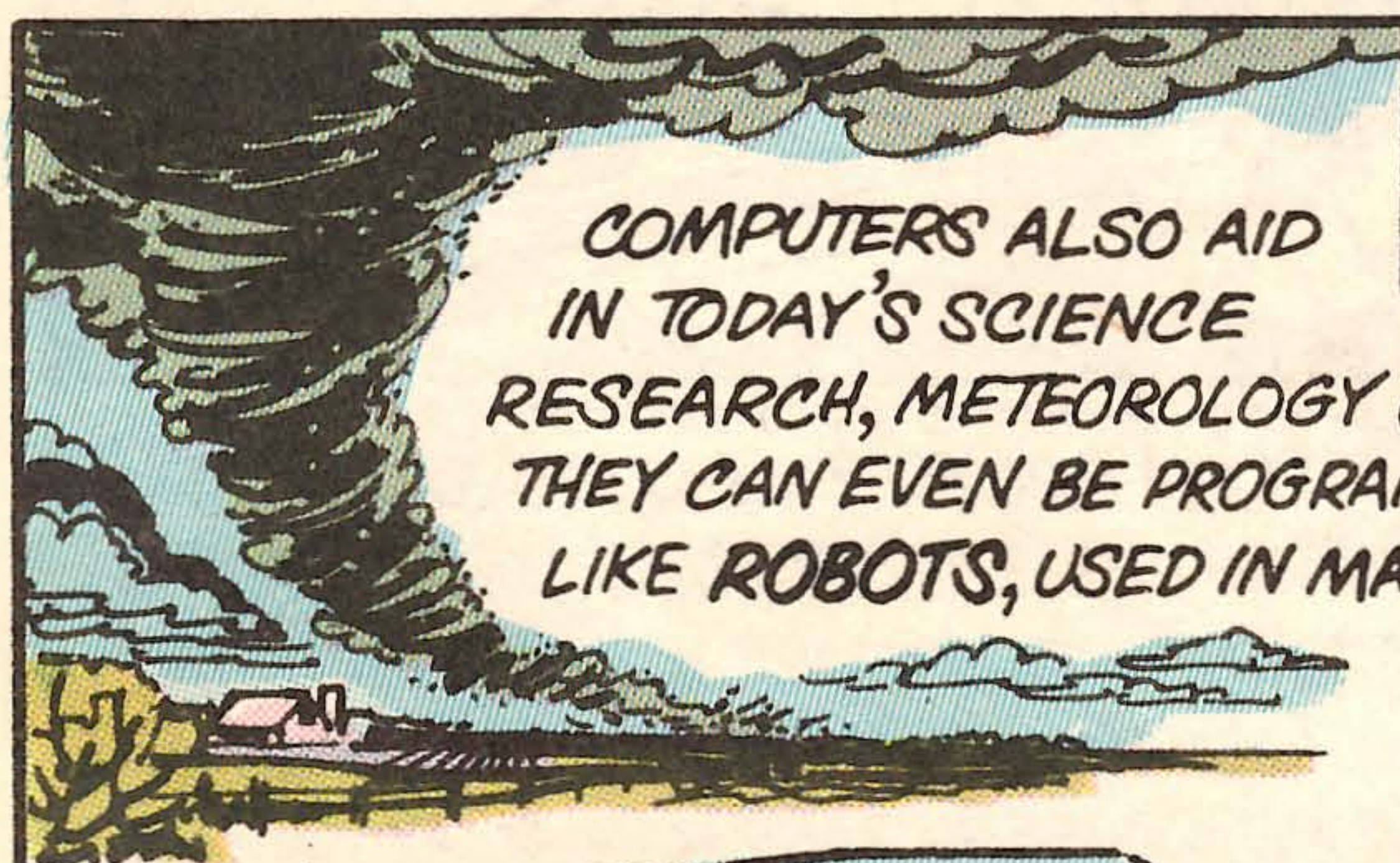
IN REDUCING TIME AND PAPERWORK FOR SMALL BUSINESS OPERATIONS...



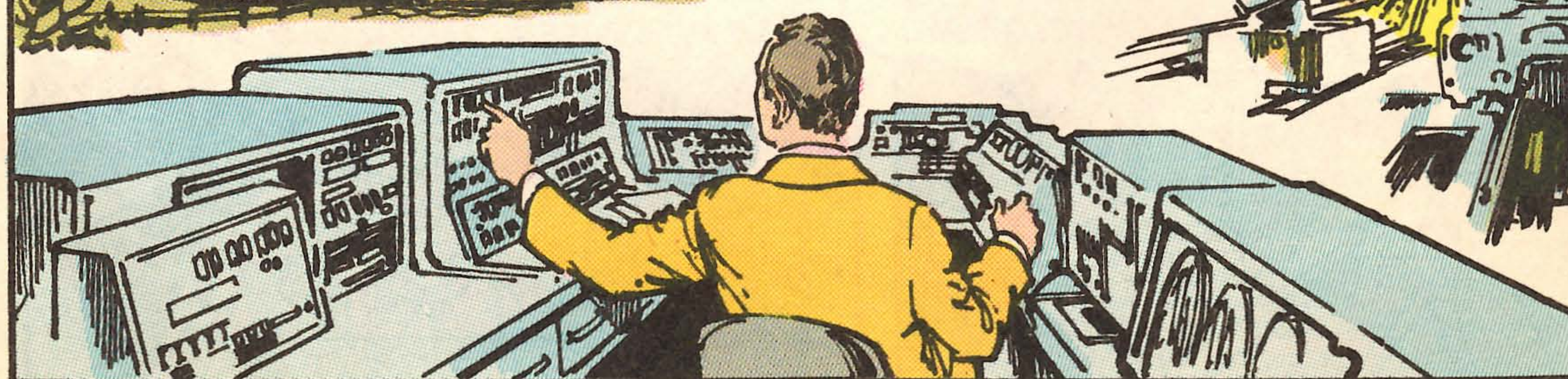
COMPUTERS LIKE THE TANDY 1000 ARE BEING USED AS TEACHING AIDS TO BUILD SKILLS IN MATH AND SCIENCE...

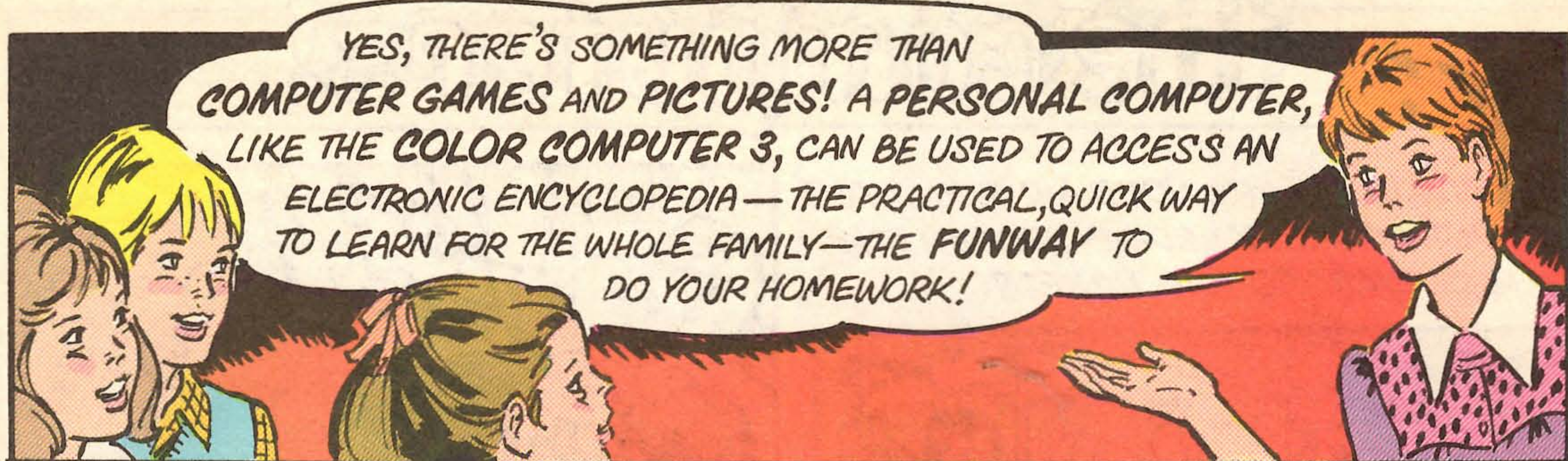


TO ACCESS INFORMATION SERVICES LIKE COMPU SERVE—AN ELECTRONIC ENCYCLO-PEDIA AT YOUR FINGERTIPS. GREAT FOR HELPING WITH HOME STUDY ASSIGNMENTS!

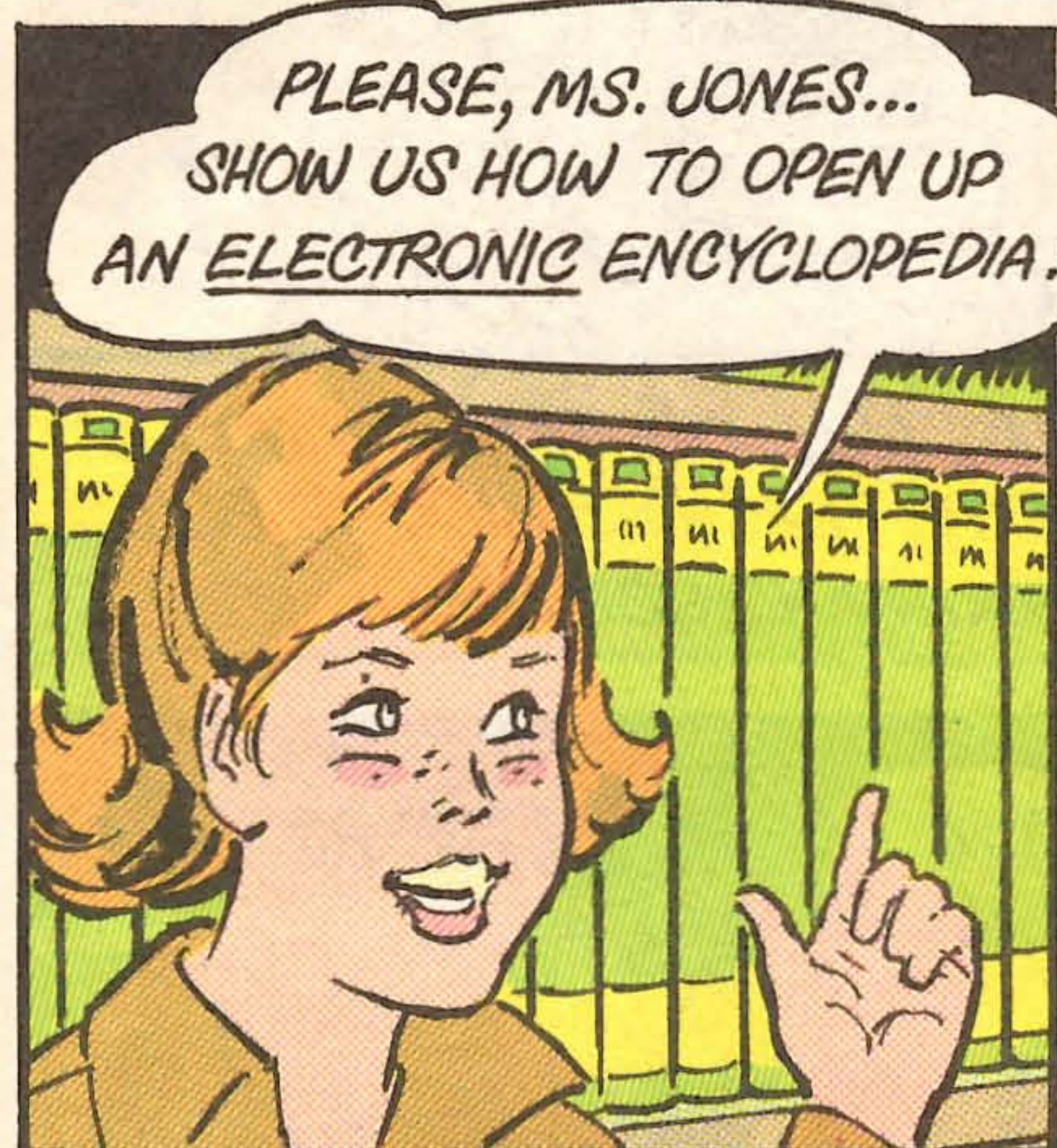


COMPUTERS ALSO AID IN TODAY'S SCIENCE RESEARCH, METEOROLOGY (WEATHER FORECASTING) AND THEY CAN EVEN BE PROGRAMMED TO OPERATE MACHINES LIKE ROBOTS, USED IN MANY MANUFACTURING PLANTS.

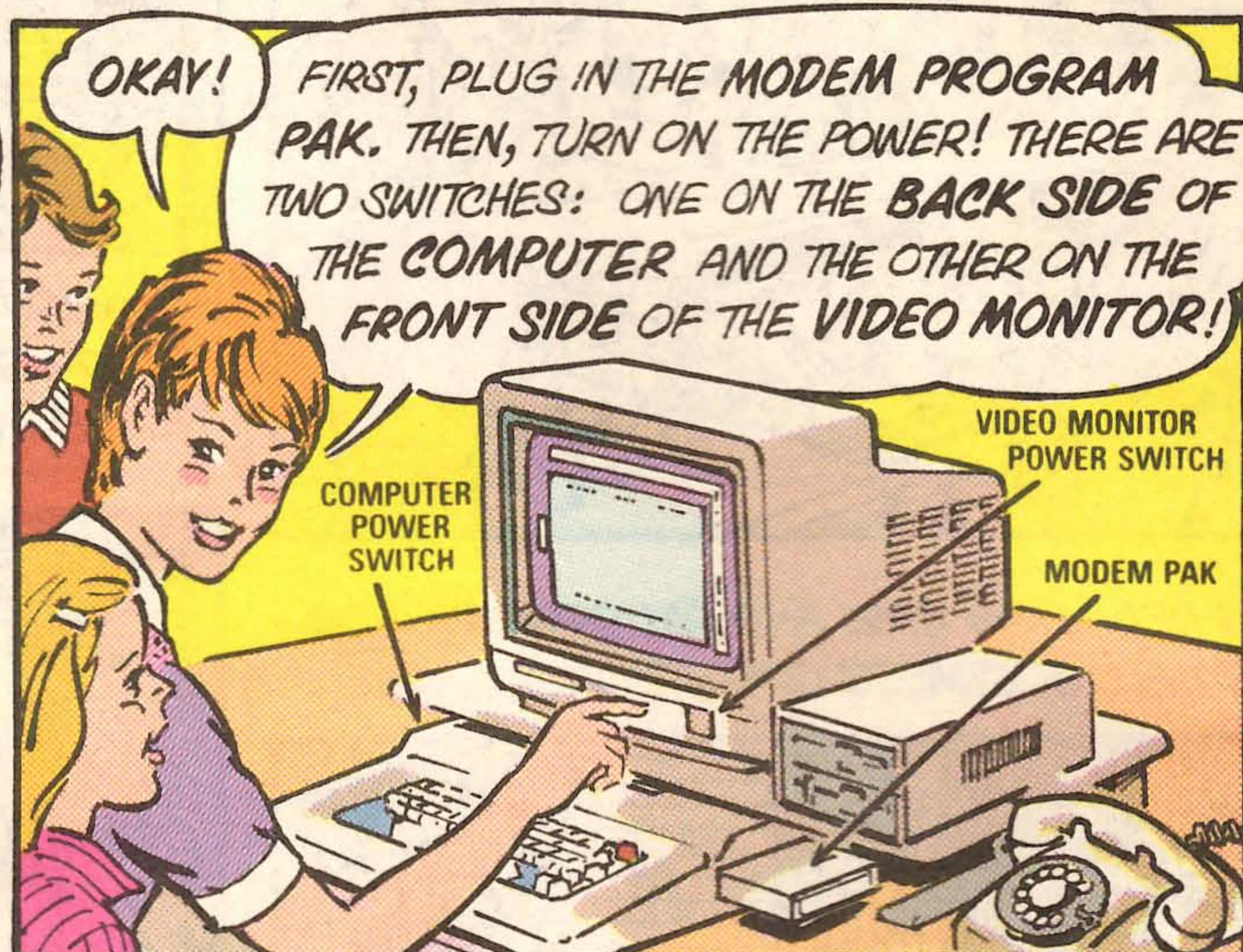




YES, THERE'S SOMETHING MORE THAN COMPUTER GAMES AND PICTURES! A PERSONAL COMPUTER, LIKE THE **COLOR COMPUTER 3**, CAN BE USED TO ACCESS AN ELECTRONIC ENCYCLOPEDIA — THE PRACTICAL, QUICK WAY TO LEARN FOR THE WHOLE FAMILY — THE FUNWAY TO DO YOUR HOMEWORK!



PLEASE, MS. JONES... SHOW US HOW TO OPEN UP AN ELECTRONIC ENCYCLOPEDIA!

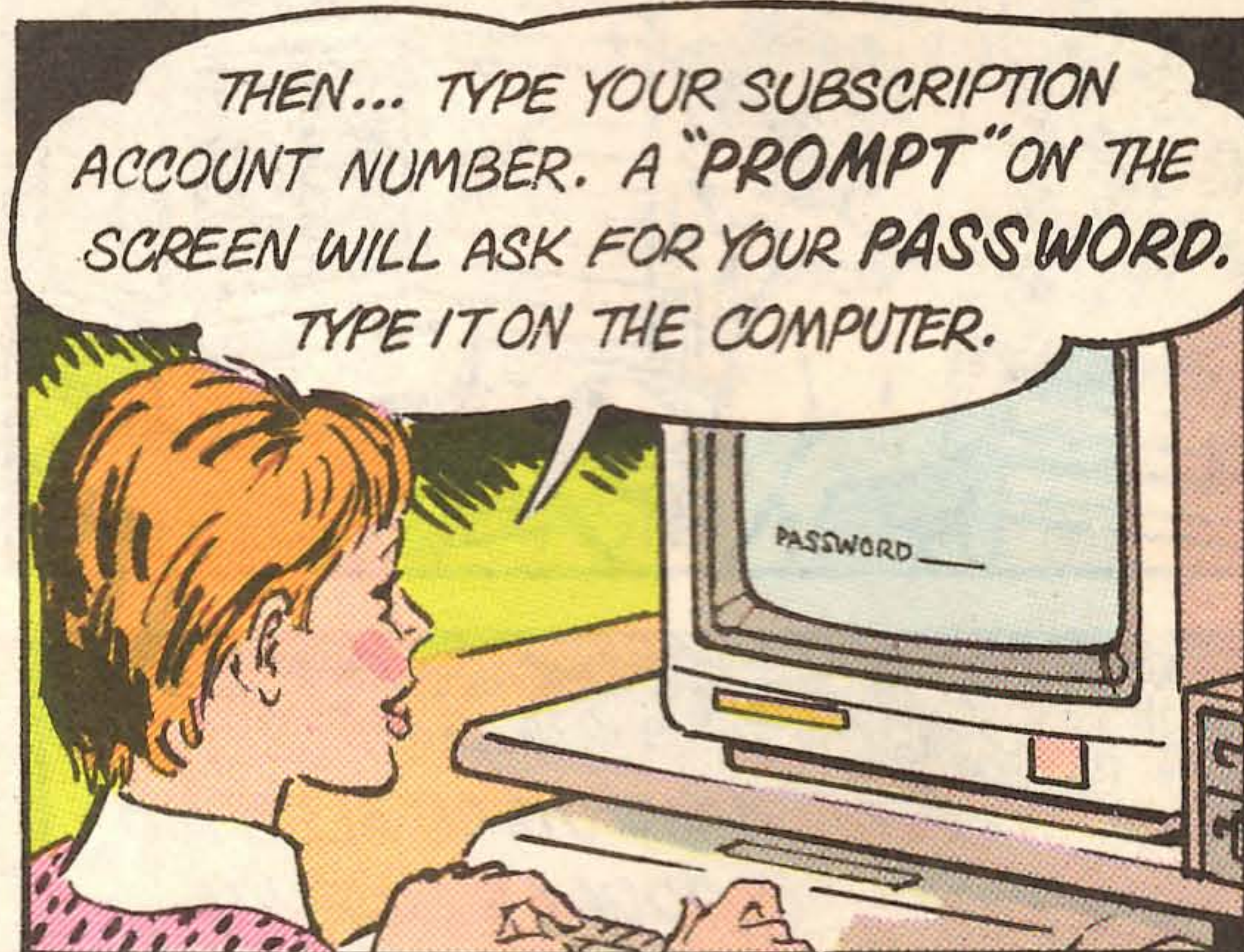


OKAY!

FIRST, PLUG IN THE MODEM PROGRAM PAK. THEN, TURN ON THE POWER! THERE ARE TWO SWITCHES: ONE ON THE BACK SIDE OF THE COMPUTER AND THE OTHER ON THE FRONT SIDE OF THE VIDEO MONITOR!



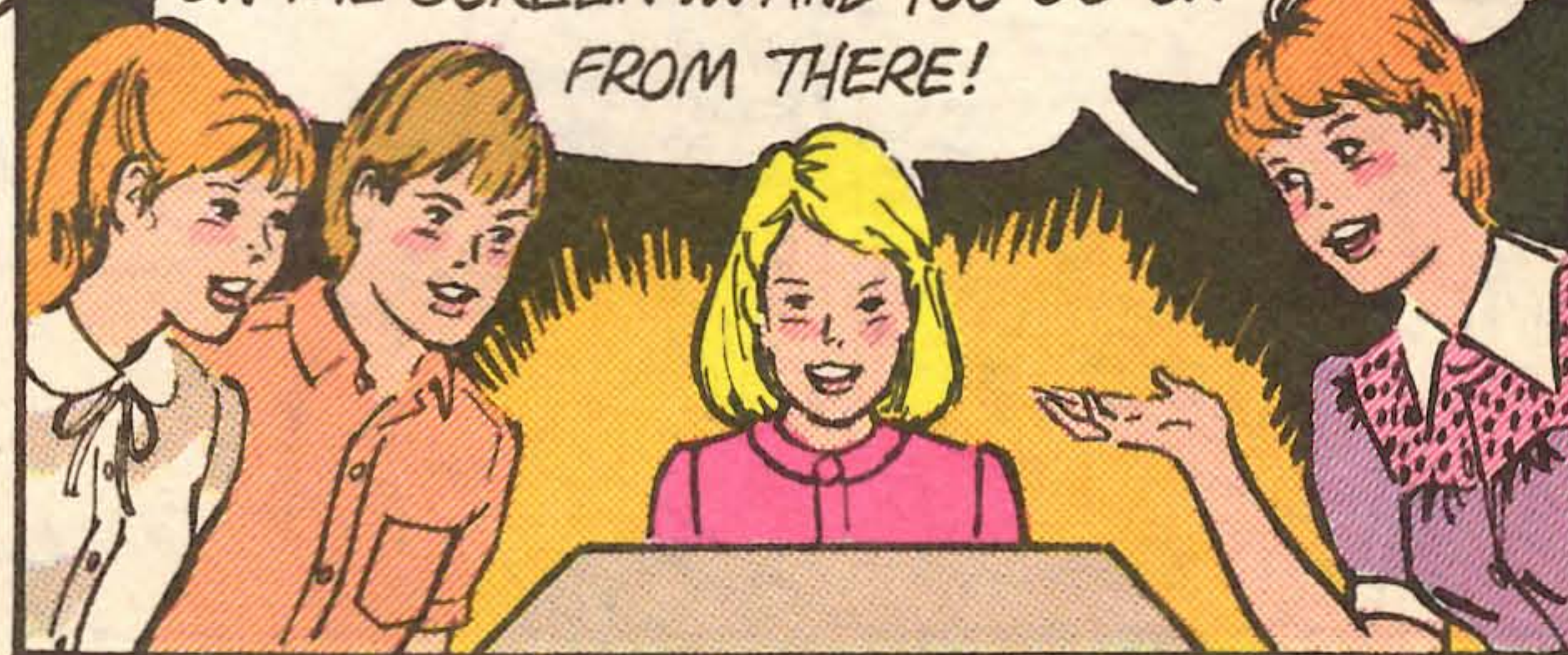
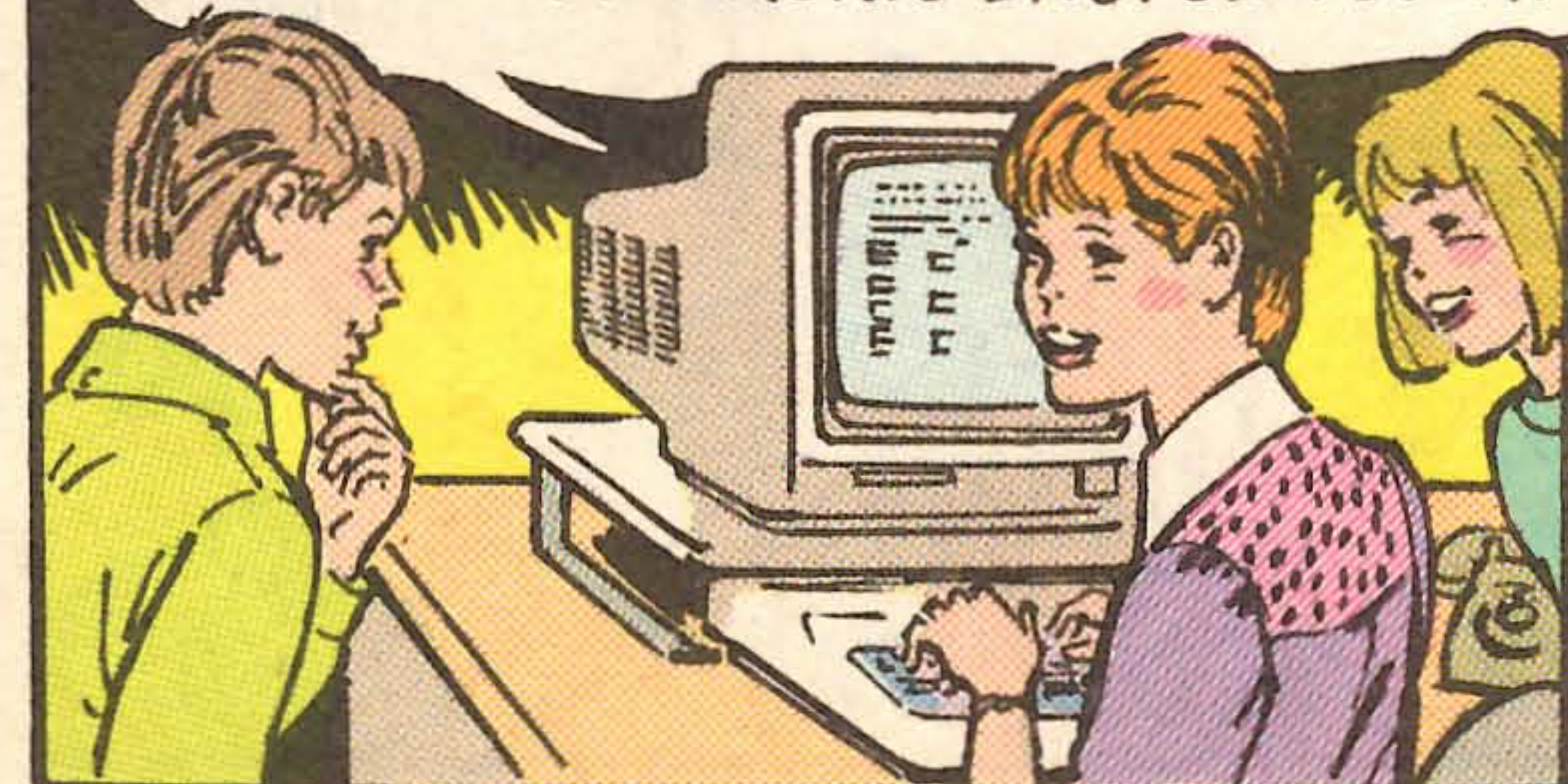
NEXT, DIAL THE PHONE NUMBER OF THE INFORMATION SERVICE THAT YOU SUBSCRIBED TO...



THEN... TYPE YOUR SUBSCRIPTION ACCOUNT NUMBER. A "PROMPT" ON THE SCREEN WILL ASK FOR YOUR PASSWORD. TYPE IT ON THE COMPUTER.

IF THE PASSWORD IS CORRECT, A PROMPT WILL ASK FOR THE CODE LETTERS FOR THE INFORMATION YOU WANT. TYPE THE LETTERS FOR THE ELECTRONIC ENCYCLOPEDIA.

THEN, A PROMPT ASKS YOU TO CHOOSE ONE OF THE CATEGORIES LISTED ON THE SCREEN. SELECT ONE... AND A PROMPT NOW ASKS YOU TO CHOOSE FROM SUBJECTS ON THE SCREEN... AND YOU GO ON FROM THERE!



THE STORY YOU HAVE JUST READ BEGAN COUNTLESS CENTURIES AGO BECAUSE OUR ANCESTORS HAD A NATURAL CURIOSITY ABOUT THINGS. EACH GENERATION EXPLORED, OBSERVED, DISCOVERED, INVENTED AND PASSED ALONG TO THE NEXT GENERATION THEIR CONTRIBUTION TO THE BODY OF KNOWLEDGE WE CALL **SCIENCE** ... AND TO A BETTER WAY OF LIFE WE CALL **FREEDOM**!



THAT'S WHY THE PILGRIMS CAME TO AMERICA IN 1620—SEARCHING FOR RELIGIOUS FREEDOM AND THE RIGHT TO GOVERNMENT BY THE PEOPLE.

...THAT'S WHY IMMIGRANTS AND DESCENDANTS OF IMMIGRANTS JOINED HANDS TO BUILD AMERICA... A NATION FOUNDED ON THE RIGHT TO **INDIVIDUAL LIBERTY**, AND THE **OPPORTUNITY** FOR ACHIEVEMENT — THE **GOLDEN KEYS** THAT BROUGHT AMERICA FROM A "DEVELOPING NATION" TO A WORLD LEADER IN AGRICULTURE, SCIENCE AND BUSINESS...



THE **GOLDEN KEYS** THAT OPENED THE DOORS FOR THE SCIENCE EXPLORERS YOU HAVE READ ABOUT IN THIS BOOK ... PEOPLE LIKE NIKOLA TESLA, SAMUEL MORSE, ALEXANDER BELL, THOMAS EDISON, JOSEPH HENRY, BENJAMIN FRANKLIN, ROYAL HOUSE, EDWIN ARMSTRONG, JOSEPH TYKOCINER, LEE DEFOREST; AND THE INVENTORS OF THE TRANSISTOR—JOHN BARDEEN, WALTER BRATTAIN, AND WILLIAM SHOCKLEY; AND MANY OTHER GREAT SCIENCE EXPLORERS!

...DEDICATED PEOPLE WHOSE YEARS OF STUDY AND COUNTLESS HOURS OF TEDIOUS RESEARCH BROUGHT US...

- ★ ALTERNATING CURRENT ELECTRICITY
- ★ TELEPHONE
- ★ RADIO
- ★ STEREO HI-FI
- ★ COLOR TELEVISION
- ★ POCKET CALCULATORS
- ★ VIDEO CASSETTE RECORDING
- ★ POWERFUL DESK-SIZE COMPUTERS
- ★ COMMUNICATION SATELLITES
- ★ MICROWAVE OVENS FOR COOKING
- ★ ELECTRONIC CONTROL AND GUIDANCE SYSTEMS FOR JETS, SHUTTLE SPACECRAFT

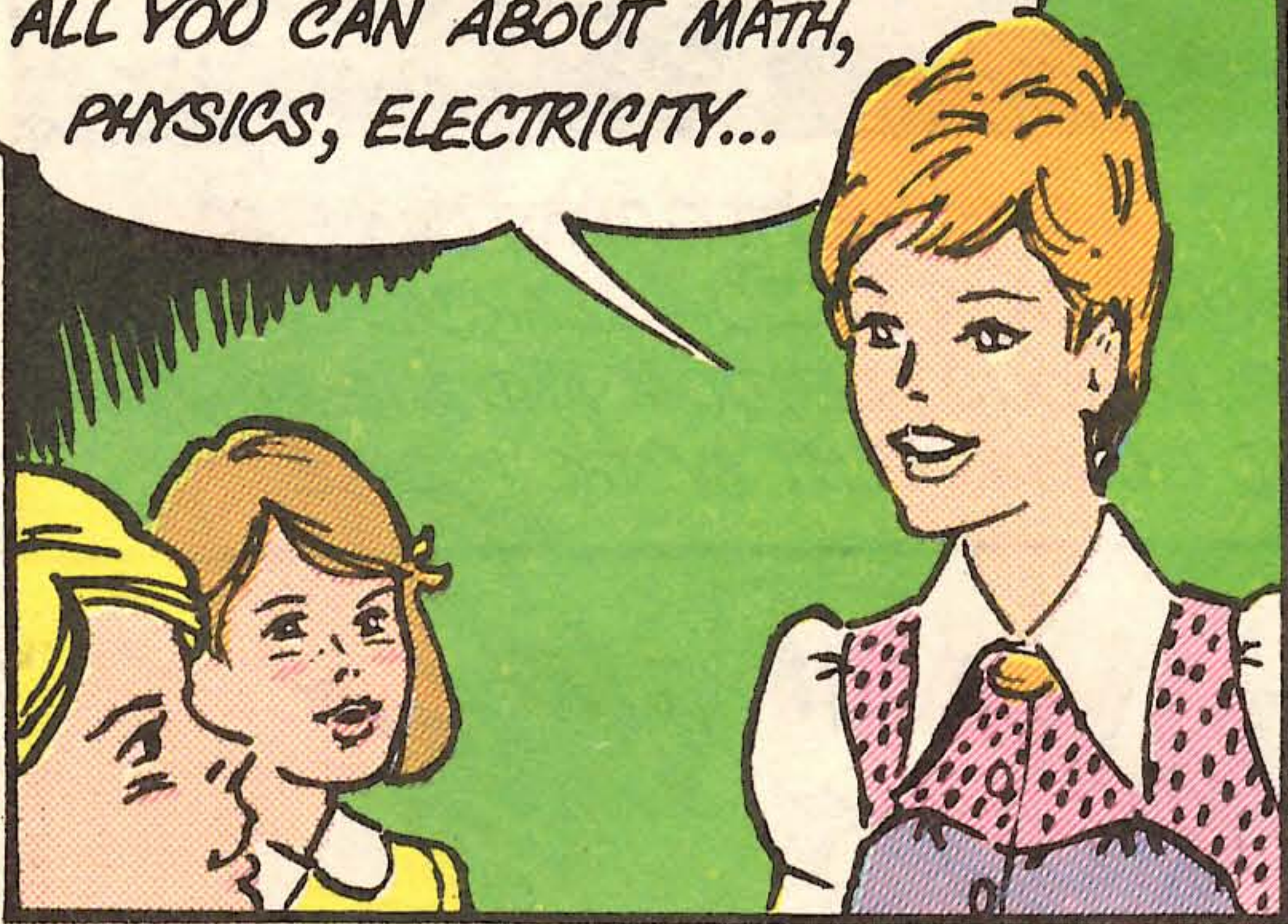


...MARVELOUS INVENTIONS OF THE PAST 111 YEARS ON PLANET EARTH!

REMEMBER, THE GOLDEN KEYS OPEN ONLY THE DOOR TO ACHIEVEMENT. REMEMBER ALSO, ACHIEVEMENT IS NOT A GIFT... IT'S UP TO YOU TO DO IT YOURSELF!



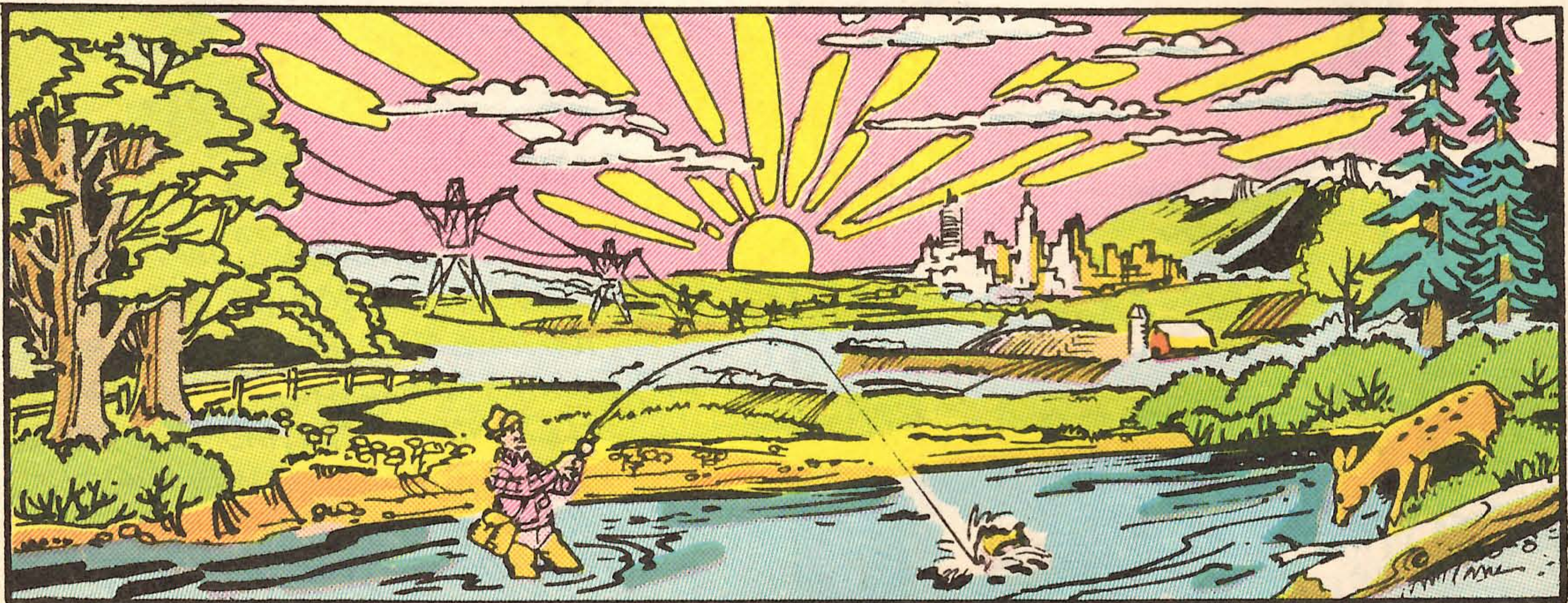
...AND THAT'S WHY YOU MUST STUDY HARD ...LEARN ALL YOU CAN ABOUT MATH, PHYSICS, ELECTRICITY...



...CHEMISTRY AND OTHER SCIENCES... SO THAT YOU CAN GAIN THE KNOWLEDGE IT TAKES TO BE A SCIENCE EXPLORER. IT'S NOT EASY, BUT YOU CAN DO IT!



YEAAY!
WE CAN DO IT!



IT WILL BE YOUR TURN TO MAKE A CONTRIBUTION TO SCIENTIFIC KNOWLEDGE THAT CONTINUES PROGRESS WITHOUT ENDANGERING OUR HOME BASE...SPACESHIP EARTH —A CONTRIBUTION THAT ALSO BENEFITS PEOPLE OF OTHER NATIONS.

WOW!

©1988 Tandy Corp.

FREE

WHILE THE SUPPLY LASTS!

a funway to learn about SCIENCE!

1.

1. SPACE EXPLORATION

... the next great adventure!

This colorful educational comic book features topics on space exploration, energy, computers, telecommunications, and the history and new developments in electronics that have shaped our world. An easy-to-read science learning aid for young and old alike!

2. ALEC and SHANNA *IN* FIT TO WIN!

A colorful two-part educational comic book . . . blending an exciting adventure story with some of the practical uses of computers in learning, and in everyday life. It stresses the importance of learning . . . and physical fitness, and cautions against substance abuse.

2.

BOING

WHERE?

GET YOUR FREE COPY at...

Radio Shack®

A division of Tandy Corporation

at participating stores and dealers in the U.S.A.

TEACHERS:

WRITE ON SCHOOL LETTERHEAD FOR A FREE PACKET
OF 50 COMIC BOOKS FOR YOUR CLASS! SEND TO
RADIO SHACK EDUCATIONAL COMIC BOOK PROGRAM
300 ONE TANDY CENTER, FORT WORTH, TEXAS 76102